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# **Work Plan**

# Sediment Predesign Investigation

for

Old Fire Fighting Training Area Naval Station Newport Newport, Rhode Island



Engineering Field Activity Northeast Naval Facilities Engineering Command Contract Number N62467-94-D-0888 Contract Task Order 0833

October 2001



# **WORK PLAN**

### SEDIMENT PREDESIGN INVESTIGATION

# **FOR**

OLD FIRE FIGHTING TRAINING AREA NAVAL STATION NEWPORT NEWPORT, RHODE ISLAND

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION - NAVY (CLEAN) CONTRACT

# Submitted to:

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# 1.0 INTRODUCTION

This work plan has been prepared to provide the sampling and analysis program proposed for Contract Task Order (CTO) 833, under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-94-D-0888. Pursuant to the CTO, Tetra Tech NUS, Inc. will execute the scope of work to perform predesign sediment investigations for the marine sediments proximal to the Old Firefighting Training Area (OFFTA), which is part of the Naval Station Newport (NSN), in Newport, Rhode Island. Data from this investigation will be used to make a preliminary determination of the volume of sediments that contain contaminants in excess of preliminary remediation goals (PRGs) established in the Draft Feasibility Study (TtNUS, April 2000).

This Draft Work Plan includes four sections: this Introduction; the Site Background, including a brief summary of existing data and the sampling and analysis program design; the Field Sampling Plan; and the Quality Assurance/Quality Control Plan. Appendix A presents Standard Operating Procedures (SOPs) for the field investigation work. Appendix B contains samples of forms to be used for documentation during this investigation.

The tasks described in this Draft Work Plan are outlined below:

- Collection of sediment samples to a maximum target depth of 2 feet below the sediment surface in and
  around the areas defined in the Draft FS report for the OFFTA site as "possible remedial action areas",
  to determine approximate limits of material that will need to be removed as a part of the remedial action
  described in that FS report,
- Analyze sediment samples to determine concentrations of PAHs and metals that exceed draft Preliminary Remediation Goals (PRGs) defined in the Draft Feasibility Study for the site, and
- Prepare and submit draft and final reports for these investigations.

After the pre-design investigation is complete the extent of sediments exceeding PRGs will be incorporated into the FS Report, and considered during the development of a Proposed Remedial Action Plan (PRAP) for the site. The PRAP will outline the plans for removal and disposal of sediment and protection of habitats present.

# 2.0 BACKGROUND INFORMATION

This section presents background information for the OFFTA site, including a site description, site history, a brief summary of previous investigations, a summary of the sampling and analysis program design, and a discussion of the project data quality objectives.

# 2.1 SITE LOCATION AND DESCRIPTION

The NSN is located approximately 60 miles southwest of Boston, Massachusetts, and 25 miles south of Providence, Rhode Island. It occupies approximately 1,063 acres, with portions of the facility located in the City of Newport and Towns of Middletown and Portsmouth, Rhode Island. The facility layout is long and narrow, following the western shoreline of Aquidneck Island for nearly 6 miles facing the east passage of Narragansett Bay. A general location map of the NSN is provided as Figure 2-1.

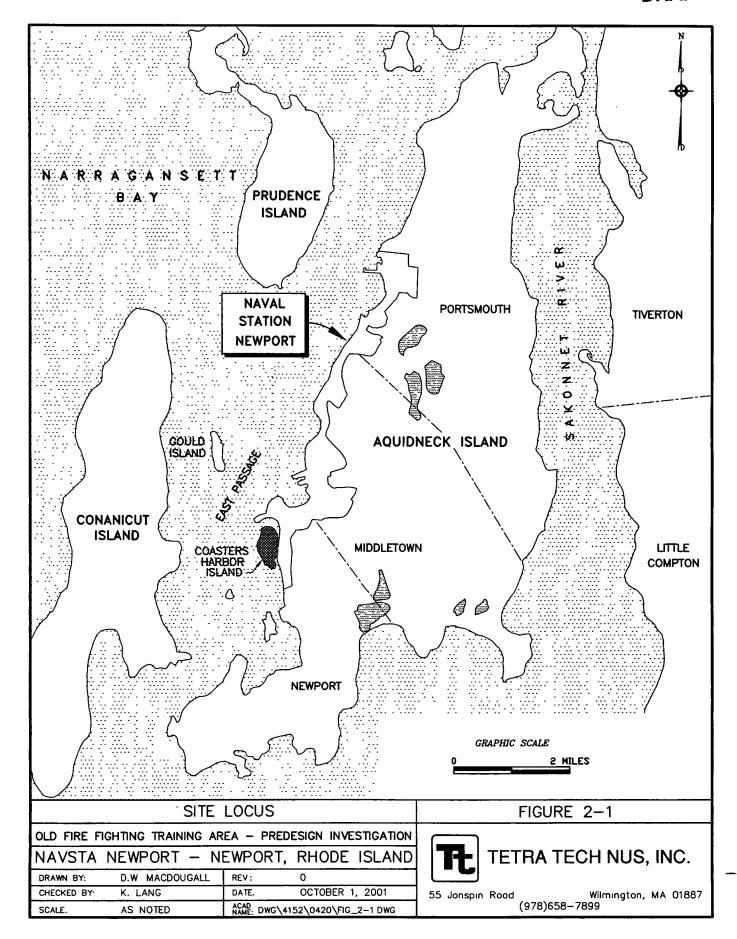
### 2.1.1 Site Conditions

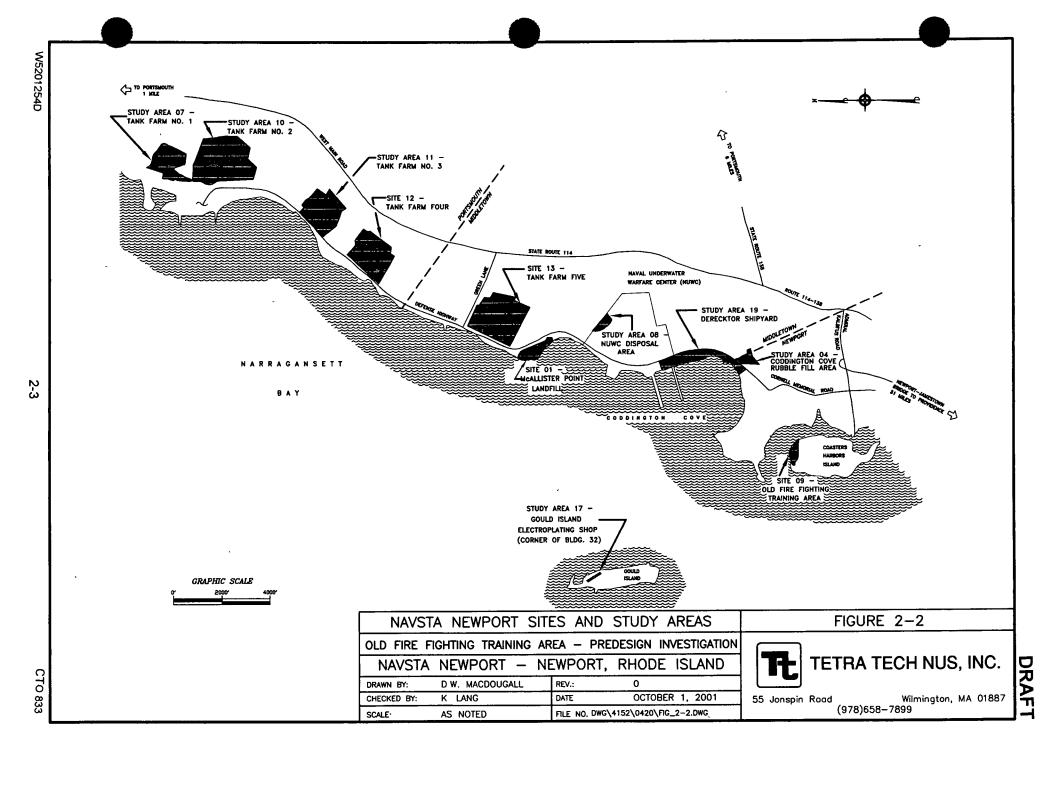
The OFFTA site is located at the northern end of Coasters Harbor Island (see Figure 2-2). The site occupies approximately 5.5 acres and is bordered by Taylor Drive to the south and is surrounded by Coasters Harbor (part of Narragansett Bay) to the east, north, and, west. The site currently contains a picnic area, playground, and baseball field. A one-story concrete block building (Building 144) is located along the southern side of the site. The building and recreational facilities at the site are not currently in use. Access to the site is restricted by a chain link fence along its eastern, southern, and western sides.

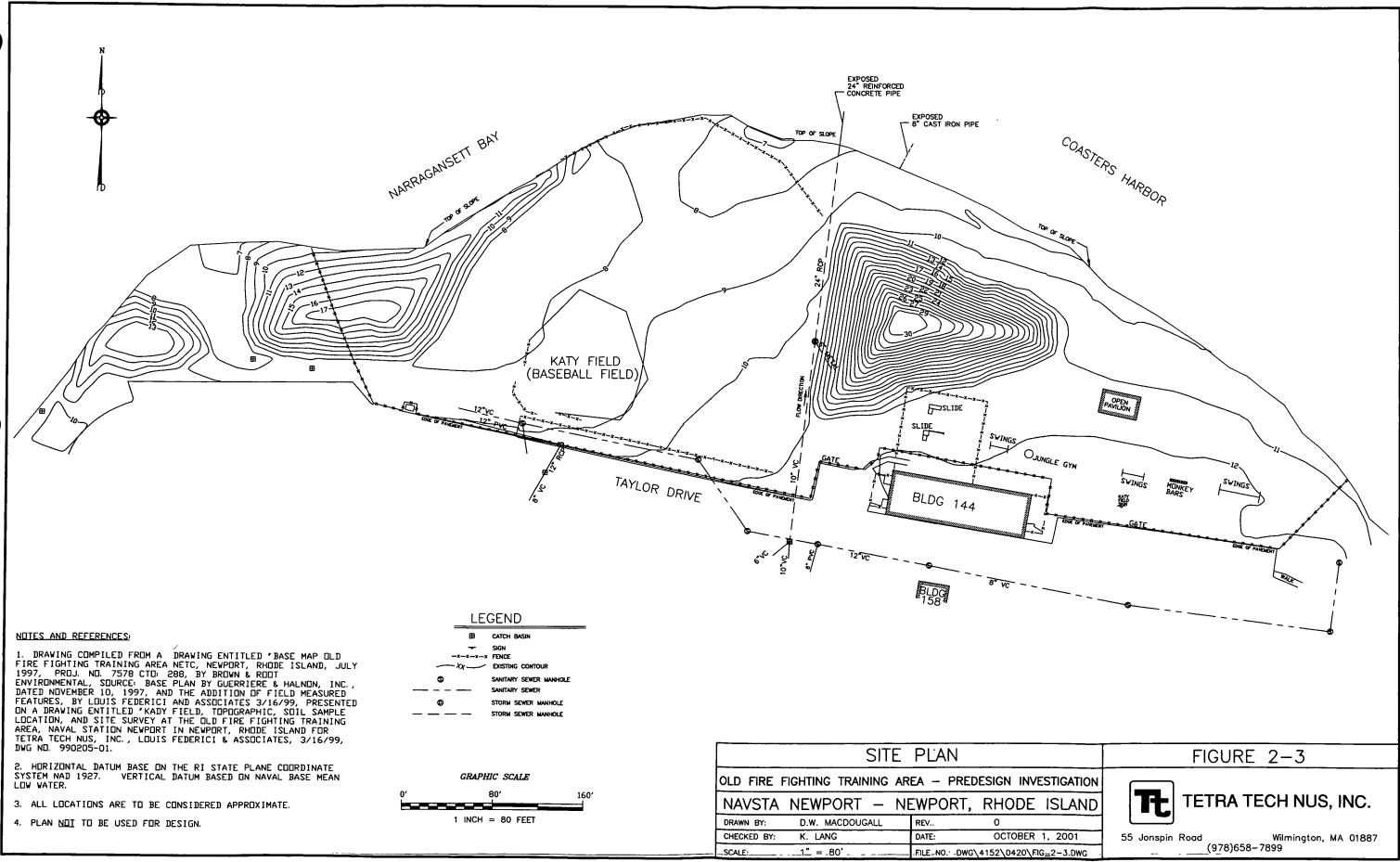
Unique topographic features at the site include three soil mounds: one that is approximately 20 feet high (30 feet above mean low water) located in the center of the site, another that is approximately 6 feet high (16 feet above mean low water) located on the western side of the site, and a third smaller mound at the far west end of the site. These mounds are believed to be the sites of the buried structures. The rest of the OFFTA site is generally flat, with surface elevations ranging from 8 to 12 feet above mean low water. With the exception of the baseball infields, the site is entirely vegetated with grass. A site plan is presented as Figure 2-3.

# 2.1.2 Marine Habitats

The marine habitat discussion presented in this section is based on data collected during the marine Ecological Risk Assessment (ERA) for the OFFTA. Refer to the Ecological Risk Assessment Report (SAIC, 2000) for complete details.







Coasters Harbor is a shallow cove connected to the East Passage of Narragansett Bay. The harbor is open at each end, north and south of Coasters Harbor Island. A wide mouth faces west at the north end of the island, and a narrow opening at the head faces south at the south end of the island. The maximum depth of the harbor at the mouth is approximately 20 feet at mean low water. At the head, the depth of the harbor is approximately 3 feet at mean low water. A tidal difference of approximately 3.5 feet has been recorded for Coasters Harbor. Circulation patterns and energies within the harbor are dominated by the tides and wind-driven flow. Hydrographic studies performed in 1996 indicate that water enters and exits at both the west and south openings and does not show a consistent directional flow pattern (Kincaid, Ellis, and DeLeo, 1996).

The estuarine system in the vicinity of OFFTA primarily includes subtidal environments, sand- or silt-substrate, with some eelgrass. The dominant taxa in the silty, subtidal, infaunal communities (less than 60 percent sand content) of Coasters Harbor included the bivalve *Nucula proxima*, *oligochaetes* species (aquatic worms), and the arthropod *Microdeutopsis*. The sandy, intertidal, infaunal communities (greater than 70 percent sand content) were found north of Coasters Harbor. Organisms and species that numerically dominated the benthic community at sandy intertidal stations included the snail *Littorina littorea*, the blue mussel *Mytilus edulis*, and, to a lesser extent, *oligochaetes* (SAIC, 2000).

The infaunal benthic, epibenthic, and pelagic communities in Coasters Harbor represent important marine habitats. Infaunal benthic communities exist within sediment depositional areas. Epibenthic communities exist on sediment depositional areas. Pelagic communities exist within the open water. Species within some of these communities include the blue mussel, the lobster (Homarus americanus), hard clams (Mercenaria mercenaria/Pitar morrhuana), and cunner (Tautogolabrus adspersus)

Other species found during field investigations of the marine environment include oysters and bay scallops. Both of these bivalves are epibenthic and very important, commercially and ecologically. Their presence in this area shows evidence of overall good health of the epibenthic environment in the subtidal areas. The benthic community is ecologically important and serves as a major food source for birds and fish, as well as for benthic and epibenthic invertebrates. As a whole, this community is potentially exposed to bulk sediment and water-borne contaminants, which presumably originate from OFFTA.

An August 2001 study of the marine environment proximal to the OFFTA site revealed the presence of a large eel grass bed along the northwest side of Coasters Harbor Island. The offshore limits of the bed extended outside the study area to the west as well as to the east. The study noted that that the eelgrass bed had a scale score of 4 to 5, which corresponds to between 70% and 100% coverage. Eelgrass was observed in both very dense (>70%) and sparse patches, however the dense patches were found to be much smaller than 10 feet in diameter. Oysters were also found in abundance during the study. This

species was identified as dominating the eastern portion of the study area. Species diversity, including both plant and animal seemed to increase from east to west. Other identified species include quahogs, mussels (in shallow water) and numerous types of vegetation and algae. Some scallops were observed during the study, and it is speculated that more scallops are also present within the eelgrass bed, however it was difficult to investigate their presence due to the density of the beds (Pare, August 2001).

Note that the Rhode Island Department of Environmental Management (RIDEM) has designated the area of Narragansett Bay along the NAVSTA Newport shoreline, including Coasters Harbor, as a shellfish closure area due to known or potential sewage discharges in the area. However, the effectiveness of the ban for preventing shellfishing is uncertain, and the ban applies only to a few species of shellfish (bivalves only); it does not apply to lobster or finfish.

# 2.2 SITE HISTORY

The NSN facility has been in use by the Navy since the era of the Civil War. During World Wars I and II, military activities at the facility increased significantly and the base provided housing for many servicemen. In subsequent peacetime years, use of on-site facilities was slowly phased out until Newport became the headquarters of the Commander Cruiser-Destroyer Force Atlantic in 1962. In April 1973, the Shore Establishment Realignment Program (SER) resulted in the reorganization of naval forces, and activity at the base again declined. This reorganization resulted in the Navy excessing some 1,629 acres of its 2,420 acres. Portions of the facility are currently leased by the Navy to the State of Rhode Island Port Authority and Economic Development Corporation. Some of these areas are, in turn, subleased to private enterprises.

The entire NSN was listed on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. The NPL identifies those sites that pose a significant threat to the public health and environment. The OFFTA site was listed as one of the sites requiring RI/FS activities. It is currently being studied by the Navy under the Department of Defense Installation Restoration Program (IRP). This program is similar to the EPA's Superfund Program authorized under CERCLA in 1980, as amended by SARA in 1986.

A Federal Facilities Interagency Agreement (FFA) for NSN (then NETC) was signed by the Navy, the State of Rhode Island, and the EPA on March 23, 1992. The FFA outlines response action requirements under the Department of Defense IRP at NSN. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NSN are thoroughly investigated and remediated, as necessary.

The OFFTA site was home to a Navy fire fighting training facility from World War II until 1972. During the training operations, fuel oils were ignited in various structures at the site that simulated shipboard compartments, and then extinguished by sailors. It was reported that the two "Carrier Compartment" buildings were injected with a water/oil mixture which was subsequently set on fire for fire fighting practice. Underground piping reportedly carried the water/oil mixture to the buildings and from the buildings to the oil-water separator shown on the figure. No other known information is available concerning the prior fire fighting training operations.

The fire fighting training facility was closed in 1972. Upon closure, the training structures were reportedly demolished and buried in mounds on the site, and then the entire area was covered with topsoil. The site was then converted to a recreational area with a playground, a baseball field, and a picnic area with an open pavilion and barbecue grills. The field was dedicated on July 4, 1976, and used as a recreational area until its closure in October 1998 due to potential environmental and human health concerns.

In its 22 years as a recreational area, the site was used for organized activities including youth day camps, picnic functions, and little league baseball (1 year only), as well as for general recreation. A child day care center operated out of Building 144 on the site from approximately 1983 through January 1994 when it was relocated off site to a larger facility on base.

Aerial photos and facility maps for the period from 1939 through 1988 were reviewed to better evaluate the site history. Activity on the site appears to date back to approximately 1943. A 1953 facility design map indicates the locations of structures and site features associated with fire fighting training exercises. An aerial photo taken in May 1944 depicts the site with structures in a similar layout to that shown on the 1953 facility design map. Based on the design map and subsequent facility condition maps, on-site structures included an administration building, hose house, two carrier compartments, smothering pit, separator pit, foam pit, simulated ship structures, suction pumps, and oil tanks.

The indexes that accompanied some of the facility conditions maps indicate that the on-site structure that was used in recent years as a day care center was once used as "wash and dressing rooms." No significant visible site changes are noted from 1944 until a 1975 aerial photo of the site, when the structures and facilities associated with the fire fighting training area are no longer evident, with exception of the "hose house" and day care center structure. As of 1987, the site appears similar to its current condition, with soil mounds visible in the central and western portions of the site and a pavilion in the east-central portion of the site.

# 2.3 PREVIOUS STUDIES

This Pre-design investigation is the second study dedicated to the chemical conditions in the marine sediment proximal to the OFFTA site. The first such study was an Ecological Risk Assessment (ERA) (SAIC, 2000) performed to assess ecological risks to the offshore environments of Coasters Harbor and Narragansett Bay from contaminants associated with OFFTA and included exposure and effects assessments, a characterization of risk, risk synthesis, and uncertainty analysis.

Risks were identified by stations based on summaries of each weight of evidence, focusing on the exposure (contaminants present) correlated to effects (reproduction and growth inhibitions, etc). Stations were rated from these summaries to exhibit properties where there is high, intermediate, and low probability for adverse risk to receptors present at those stations.

The assessment found a high probability for adverse risk at one station (Station 5), close to the outfall at the central shoreline of the site, likely from PAHs and metals present at this area. Intermediate probability for risk was estimated for a number of stations at the nearshore area and in the harbor sediment, including one reference station south of Coasters Harbor, but because a clear exposure-response relationship was not found, these risks may be considered acceptable from an ecological perspective. Low probability for adverse risk was estimated for the remainder of the stations, including one reference station and the nearshore stations more exposed to rough water conditions. The observed risks at these stations are considered acceptable from an ecological perspective. A baseline condition associated with relatively pristine conditions was not observed at any of the site or reference stations evaluated in the risk assessment.

The findings from the ERA were included in a Feasibility Study (FS) conducted to approach various ways to address the contaminated soil and marine sediment at the OFFTA site. Previous studies were utilized in creating the FS including several phases of remedial investigations, a human health risk assessment, and the marine ecological risk assessment discussed above. Results of these investigations indicated that site activities have resulted in the release of both organic and inorganic contaminants. For marine sediment, semi-volatile organic compounds and one metal exceeded concentrations protective of human health and the environment. In addition to the sediment contamination, these investigations revealed debris including granite blocks, concrete slabs, bricks and asphalt present along the shoreline.

# 2.4 SAMPLING AND ANALYSIS PROGRAM DESIGN

This predesign investigation involves the sampling and analysis of marine sediments. It has been developed to provide data from nearshore and offshore areas to determine approximate limits of material

that will be considered for remedial action as part of the FS and Proposed Remedial Action Plan for the site. Sediment sampling locations for this investigation are presented in Section 3.

# 2.5 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) for this project were developed in accordance with the EPA Guidance for Data Quality Objectives (EPA G4 document). The G4 document suggests seven steps be followed to develop project DQOs. DQO development was completed in a cursory manner for this project, since the objectives are in part dictated by CERCLA guidance, the Federal Facilities Agreement, and other standard guidances to perform investigations.

The intended use of the data resulting from a field investigation is the primary determining factor in defining the DQOs for that data. To be certain that the data are consistent with the goals of the investigation, the seven steps of defining DQOs are presented in this section.

# 2.5.1 Statement of the Problem

As detailed in Section 2.2, the OFFTA site was home to a Navy fire fighting training facility from World War II until 1972. During the training operations, fuel oils were ignited in various structures at the site that simulated shipboard compartments, and then extinguished by sailors. It was reported that the two "Carrier Compartment" buildings were injected with a water/oil mixture which was subsequently set on fire for fire fighting practice. Underground piping reportedly carried the water/oil mixture to the buildings and from the buildings to the oil-water separator. Currently, as a result of these activities, there is contamination present in soil, groundwater and marine sediments at the OFFTA site. Investigations at the site have concluded that the marine sediment in the area contains PAHs and arsenic at concentrations that pose a potential human health and ecological risk, and exceed PRGs. It has been determined that the sediments with contaminant concentrations exceeding PRGs must be considered for remedial action. Based on current data, the area of the shoreline and nearshore portion of the site, approximately 130,500 square feet (3.0 acres) of sediment is under such consideration, corresponding to approximately 9,670 cubic yards. An area of 10,800 square feet (0.25 acre) of eelgrass beds is assumed to be present in the area of contaminated sediment. Based on the limited data points evaluated during the risk assessments to calculated these numbers, additional sampling during this investigation is required to refine these numbers further so that accurate conclusions can be drawn regarding the remedial and removal activities that will take place at the site.

The problems this investigation will address are:

- What is the lateral and vertical extent of contaminants exceeding PRGs in sediment?
- What is the lateral and vertical extent of sediments in the nearshore and elevated risk offshore areas that are contaminated at levels exceeding the PRGs established in the FS (TtNUS, March 1999)?
- What is the resulting volume of sediments that require removal as part of the remedial action?
- How much of the sediment within the eelgrass beds exceed PRGs?

This investigation will focus on the contaminants for which PRGs were established in the FS: including PAHs and arsenic.

# 2.5.2 <u>Identification of the Decision</u>

After the completion of this study, the extent of sediment exceeding PRGs will be considered for remedial action.

# 2.5.3 <u>Inputs to the Decision</u>

Inputs to the decision are the elements used in the decision process. Inputs to the decision as stated in Section 2.5.2 are as follows:

- Concentrations of contaminants present
- Locations of samples with PRG exceedances
- Depths of samples with PRG exceedances

PRGs have been estimated in the Draft Feasibility Study Report, Appendix B, (TtNUS April 01) for PAHs and metals. These PRG values define detection limits needed for pre-design sediment sampling. Draft PRGs are as follows: 2-methylnapthalene, 135 ug/kg; acenapthalene, 502 ug/kg; benzo(a)pyrene, 134 ug/kg benzo(g,h,l)perylene, 3,518 ug/kg; indeno(1,2,3-cd)pyrene 426 ug/kg; arsenic, 5.5 mg/kg; cadmium, 10 mg/kg; chromium 3,708 mg/kg; and mercury 2.3 mg/kg.

# 2.5.4 <u>Definition of the Study Boundaries</u>

Study boundaries include the upper limit of the intertidal zone within the site boundaries offshore to approximately 150 feet from mean low water. Samples collected beyond this distance have been found to not exceed PRGs during previous sampling efforts. A maximum target sample depth of two feet has

been selected as this is one zone of bioturbation (sediment that is contacted by ecological receptors) and a maximum erosional depth from wave and storm conditions.

# 2.5.5 <u>Decision Rule</u>

The decision rule is a clear statement defining the requirements of the investigation based on the possible outcomes of the study. For this work plan, the decision rule shall be that sediments found to contain contaminants at concentrations exceeding PRGs will be considered for remedial action. The volume of these materials will be identified upon the evaluation of the results from this investigation. The remedial action will be determined through completion of the FS, PRAP and Record of Decision (ROD).

# 2.5.6 <u>Limits on Decision Errors</u>

The limits of decision errors are set to quantify the potential for false negative and false positive decisions. This study was designed to result in a low potential for a false negative decision, i.e., a decision not to proceed with sediment removal in a particular area when the conditions identified in the Decision Rule actually do exist and the sediment should be removed or monitored. Conversely, a somewhat higher tolerance for a false positive decision is acceptable for this investigation because the resulting effect is only that some sediments that actually do not require action are included with the sediments meeting the defined conditions for remedial action. Because of this tolerance for a false positive detection, a relatively low number of sample stations are required to identify the limits of contaminated sediments in the areas under investigation.

# 2.5.7 <u>Design for Obtaining Data</u>

The DQO process described in the G4 DQO document describes the use of various statistical approaches for developing a database. These approaches are based on the representativeness of the data that is required. A statistical approach was not used for development of the sampling plan, rather as detailed in Section 3 and Section 2.5.4, this plan is based on previous data that identified potential limits of contaminated sediments that may require removal under the remedial action. This investigation was designed around that data to obtain better resolution on the lateral and vertical extent of sediments exceeding PRGs. Specifics on the precision, accuracy, etc. of the data collected are described in the Quality Assurance/Quality Control Plan, presented in Section 4 of this work plan.

# 3.0 FIELD SAMPLING PLAN: PRE-DESIGN INVESTIGATIONS

This section presents a description of the field investigation activities that are planned for the Pre-Design Investigation for marine sediments located adjacent to the Old Fire Fighter Training Area at the Naval Station - Newport, in Newport, Rhode Island.

The objective of the marine sediment sampling activity is to provide data to assess the horizontal and vertical extent of contamination in the marine sediment. The resulting data will be evaluated to determine the volume of sediment that will be considered for remedial action described in the FS.

The following sections detail the marine sediment sampling activities that comprise the Pre-Design Field Investigations to be described under this work plan. Figure 3-1 depicts sediment sampling locations.

Activities associated with the pre-design investigations include:

- 1. Mobilization/demobilization activities:
- Collection of core sediment samples to evaluate the existing subsurface conditions and to serve as delineation borings for the purpose of evaluating the volume of sediments that will require removal under the planned remedial action;
- 3. Investigation-derived waste (IDW) disposal activities.

In addition, as part of the sampling activities the location of each sample will be marked using a labeled buoy to be anchored in place, and will be located using a portable digital global positioning system (GPS) unit with sub-meter accuracy. Location information will be translated into NAD 1983 state plane coordinates, and each sampling location will be incorporated into the Arcview EGIS Database System for NSN.

# 3.1 MOBILIZATION/DEMOBILIZATION

As part of mobilization activities, technical specifications for sample collection and analysis subcontracts will be prepared and issued. Required field equipment and supplies will be ordered and mobilized to the site. Field team members will review this Work Plan, the Health and Safety Plan (provided under separate cover), applicable Standard Operating Procedures (SOPs, included as Appendix A), and applicable subcontract specifications. A field team orientation meeting will be conducted prior to initiating the fieldwork

to familiarize the field team and subcontractor personnel with site health and safety requirements and the scope of the field activities.

### 3.2 SAMPLE COLLECTION

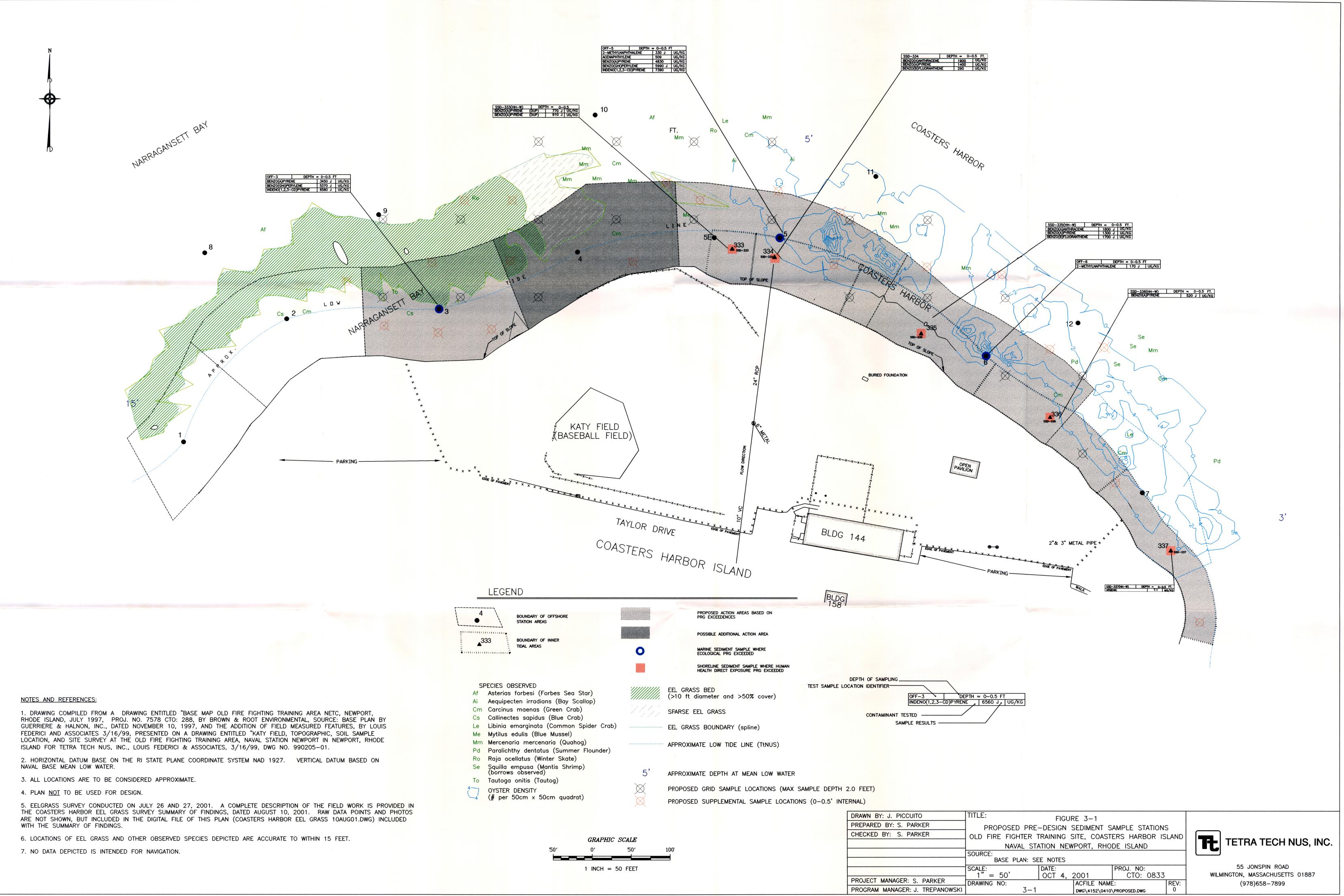
The objective of the sample collection is to determine the volume of sediment that will be considered for the remedial action. Samples will be collected in three groups as described in the following subsections. Table 3-1 presents a summary of field and QC samples, Table 3-2 presents the analytical methods, volume and preservatives required.

# 3.2.1 Samples Collected from Grid Points Within the Eelgrass Areas

An estimated 12 samples will be collected from locations within the eelgrass bed at 100 foot intervals as shown in Figure 3-1. Stations will initially be plotted in the field using a GPS and marked with an anchored buoy. Sediment cores from intervals of 0.0-0.5 feet and 0.5-1.0 feet will be collected from those grid locations within the eelgrass area. A subcontracted diver will collect each sample using an acetate lined coring device. If refusal is encountered at any depth above the target depth for that location, the diver will move no further than a one-half meter radius from the initial position. If refusal above the target depth is encountered after four attempts, then the samples from the core with the maximum depth achieved will be selected for analysis.

It is anticipated that the sampling will be conducted from an open 20 foot work boat. A subcontractor with diving expertise will carry out the sample collection under the supervision of a TtNUS field geologist/engineer. Upon retrieval, the inner core (acetate liner) will be given to the TtNUS field representative for containenzation. Upon opening, the TtNUS field representative will log the core sample on a sample log. Each core will be inspected for visual evidence of potential contamination, and then packaged for shipment to the analytical laboratory.

Sediment core samples will be collected utilizing a split-spoon-like, acetate-lined stainless steel sampling device. The sampler will drive the coring device into the sediment to the target depth, then remove the acetate liner and place end caps on it to retain the sediment structure. Samples will be lifted to the surface and passed to a TtNUS representative, who will cut the acetate core liner, and deposit it into a stainless steel bowl. Large stones and shell matter will be removed. In the event that the resulting sample volume is not sufficient to fill sample jars from the selected interval, a second co-located coring may be advanced in order to provide sufficient sediment volume for all analyses. The remaining portion of sediment will be homogenized and transferred to the appropriate sample containers, as detailed in Table 3-2. Table 3-2 also includes analytical methods, preservatives, and holding time requirements.



# **DRAF1**

# TABLE 3-1 FIELD AND QUALITY CONTROL SAMPLE SUMMARY OFFTA MARINE SEDIMENT PREDESIGN INVESTIGATION NAVAL STATION NEWPORT, NEWPORT, RHODE ISLAND

SAMPLE TYPE	ANALYSIS	FIELD SAMPLES	FIELD (AMBIENT) BLANKS <sup>(2)</sup>	RINSATE (EQUIPMENT) BLANKS <sup>(3)</sup>	FIELD DUPLICATES <sup>(4)</sup>	SOURCE BLANKS <sup>(5)</sup>	TOTAL
Surface and Subsurface Sediment Samples	PAH Compounds TAL Metals	92 92	2 2	8 8	9	2 2	113 113

### Notes

- (1) Collected as sediment, laboratory will extract porewater and analyze as water
- (2) One per sampling event (assume 1 for grid samples and 1 for supplemental samples).
- (3) Collect one rinsate blank per sampling day
- (4) Collect 1 per 10 field samples
- (5) Collect 1 per water source per event (assume 1 for grid samples and 1 for supplemental samples)

# TABLE 3-2

# ANALYTICAL METHODS, SAMPLE CONTAINER, PRESERVATIVE, AND HOLDING TIME REQUIREMENTS OFFTA MARINE SEDIMENT PREDESIGN INVESTIGATION NAVAL STATION NEWPORT NEWPORT, RHODE ISLAND

SAMPLE MEDIUM	ANALYSIS <sup>(2)</sup>	SAMPLE CONTAINER <sup>(1)</sup>	PRESERVATIVE	HOLDING TIME
Soil	PAHs, SW-846 8270C SIM	8 oz wide mouth jar	Cool to 4°C	7 Days (Extraction)
	TAL Metals SW-846 6010B Trace <sup>(3)</sup>	4 oz wide mouth jar	Cool to 4°C	14 Days (Analysis)
Aqueous	PAHs, SW-846 8270C SIM	1 Liter Amber	Cool to 4°C	7 Days (Extraction)
(QC samples)	TAL Metals SW-846 6010B Trace <sup>(3)</sup>	1 Liter Polyethylene	Nitric Acid to pH <2	14 Days (Analysis)
]`				

### Notes:

- (1) Triple volume needed for organic laboratory QC, and double volume needed for metal laboratory QC, at a rate of one per 20 field samples. Also, actual volumes and bottle requirements needed for all analyses will be verified with the selected analytical laboratory prior to initiation of sampling event
- (2) Method detection limits adequate for determining PRG exceedances, as discussed in Section 2 5 3
- (3) ICP mass spectometry may be used for analysis at detection limits necessary.

# 3.2.2 <u>Grid Points Outside Eelgrass Areas</u>

An estimated 60 samples will be taken from 15 different locations from grid points outside the eelgrass area. These samples will be collected at four half-foot intervals (0.0'-0.5', 0.5'-1.0', 1.0'-1.5', 1.5'-2.0'), from 0.0 to 2.0 feet. The procedure for locating positions and collecting these samples will be the same as described in Section 3.3.1 with a subcontracted diver collecting each sample using an acetate lined coring device. Again, if refusal is encountered at any depth above the target depth for these locations outside the eelgrass, the diver will move no further than a one-half meter radius from the initial position. If refusal is encountered after four attempts, then the samples from the core with the maximum depth will be selected for analysis.

# 3.2.3 Supplemental Samples

Supplemental samples, will be samples collected from non-grid points. These will be collected as one sample from each location, from the 0.0-0.5 interval. The purpose of these samples is to identify contaminant concentration off the grid to form a more complete picture of the extent of contaminated sediments at the OFFTA site. There are 20 such sample locations, and with one sample being collected from each location, 20 supplemental samples are estimated. All procedures for collecting these samples are identical to those described in Section 3.3.1.

# 3.3 INVESTIGATION-DERIVED WASTE (IDW) DISPOSAL

Any IDW generated will be collected and stored in 5-gallon buckets for disposal off site. Chemical analysis for disposal parameters will be performed by the disposal contractor, if necessary, based on current restrictions and regulations. Any PPE waste generated during work will be decontaminated and stored in plastic bags for disposal at the end of each work day. The bags will be placed in an industrial dumpster at a location to be determined by the Navy.

# 3.4 DECONTAMINATION PROCEDURES

All non-disposable sampling equipment that comes in contact with the sample medium will be decontaminated to prevent cross-contamination between sampling points. This includes equipment such as sediment sampling spatulas, stainless steel bowls, scoops, split spoons, ponar samplers, etc. The following decontamination sequence will be employed:

- remove gross contamination by scrubbing with potable water
- scrub with potable water/liquinox
- rinse with potable water

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- rinse with deionized water
- rinse with 2-propanol
- air dry (to extent possible)
- wrap with aluminum foil, dull side toward equipment.

# 4.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

This section provides technical guidelines and procedures for maintaining an appropriate level of quality for data collected during fieldwork performed. This section references the TtNUS Standard Operating Procedures (SOPs) for specific protocols for procedures discussed in Section 3.0.

Pertinent SOPs and ASTM methods for fieldwork are included in this work plan as Appendix B. These SOPs include, but are not limited to:

SOP	DESCRIPTION
CT-04	Sample Nomenclature
CT-05	Database Records and Quality Assurance
GH-1.5	Borehole and Sample Logging
SA-1.2	Surface Water and Sediment Sampling
SA-1.3	Soil Sampling
SA-6.1	Non-Radiological Sample Handling
SA-6.3	Field Documentation
SA-7.1	Decontamination of Field Equipment and Waste Handling

# 4.1 QUALITY ASSURANCE OBJECTIVES

The main objective of this round of environmental sampling is to provide sufficient data, when evaluated with existing data, to determine the approximate limits of sediments that will require removal under the remedial action described in the proposed plan.

Achieving this objective requires that the data collected from the field conform to an appropriate level of quality. The quality of a data set is measured by certain characteristics of the data, namely the precision and accuracy, representativeness, completeness, and comparability (PARCC) parameters. Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The PARCC goals for a particular project are determined by the intended use of the data, defined as a part of the Data Quality Objectives (DQOs). DQOs are discussed in Section 2.5; the PARCC parameters are discussed below.

# 4.1.1 PARCC Parameters

The PARCC goals for the work covered by this quality assurance plan are discussed in the following sections.

# 4.1.1.1 Precision and Accuracy

Field and laboratory precision and accuracy performance can affect the attainment of project objectives, particularly when compliance with established criteria is based on laboratory analysis of environmental samples.

Field sampling precision and accuracy are not easily measured. Field contamination, sample preservation, and sample handling will affect precision and accuracy. By following the appropriate TtNUS SOP, precision and accuracy errors associated with field activities can be minimized. Field duplicates and blanks (field and rinsate) will be used to estimate field sampling precision and accuracy for samples submitted for laboratory analysis.

Field duplicate and field quality control blank analyses results will be used to review the laboratory-analyzed results and determine the usability of the data with respect to its intended use. As discussed in Section 2.5.6, the study was designed to have a relatively low tolerance for a false negative decision (i.e. sediment does not exceed PRGs, therefore no action necessary) and a high tolerance for a false positive decision (i.e., sediment exceeds PRGs, therefore station is considered for remedial action). As a result, it was determined that formal validation of the data would not be conducted to verify laboratory precision and accuracy.

# 4.1.1.2 Representativeness

Representativeness describes the degree to which analytical data accurately and precisely define the population being measured. Several elements of the sampling and sample handling process must be controlled to maximize the representativeness of the analytical data (appropriate number of samples collected, physical state of the samples, site-specific factors, sampling equipment, containers, sample preservation and storage, holding times, sample identity, and chain of custody will be defined to ensure that the samples analyzed represent the population being measured). The sampling program is designed to provide analytical data that are representative of the existing contaminant levels.

Representativeness of data is also affected by sampling techniques. Errors or cross-contamination during the sampling could affect the laboratory analytical results. However, every effort will be made during sample collection to minimize the introduction of errors or cross-contamination by following the sample techniques described in Section 3.0, and in the TtNUS Standard Operating Procedures (SOPs) included in Appendix A.

# 4.1.1.3 Completeness

Completeness describes the amount of data generated that meets the objectives for precision, accuracy, and representativeness versus the amount of data expected to be obtained. For relatively clean, homogeneous matrices (such as water), 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase (such as for sediment), completeness may decrease. Where analysis is precluded or where data quality objectives are compromised, effects on the overall investigation must be considered. Whether or not any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

The sampling and analysis program for the site is sufficiently broad in scope to prevent a single data point or parameter from jeopardizing attainment of the study objectives. Cntical data points may not be evaluated until all the analytical results are evaluated. Additionally, several sampling points, in aggregate, may be considered to be critical either by location or by analysis. A subsequent sampling event may be necessary if it becomes apparent that the data for a specific medium are of insufficient quality, either with respect to the number of samples or based on an individual analysis.

For the purposes of this effort, a data point will be determined to contribute to the completeness of the data set if the information provided is meaningful, useful, and contributes to the project objectives.

# 4.1.1.4 Comparability

One of the objectives of the sampling effort is to provide analytical data that are characterized by a level of quality that is comparable between sampling points. By specifying the use of standard analytical procedures (as well as standardizing field sampling procedures by employing TtNUS and others SOPs), the potential for variables to affect the final data quality will be effectively minimized. Analytical methods for this work are presented in Table 3-2; SOPs appear in Appendix A.

# 4.1.2 Quality Control Samples

QC samples to be used during the sampling effort are identified below, and include field duplicates or replicates, laboratory duplicates or replicates, rinsate blanks, field blanks, and source blanks. Each type of field quality control sample defined below will undergo the same preservation, holding times, etc., as the field samples. Table 3-1 presents a summary of the QC samples to be collected during this sampling event.

### 4.1.2.1 Field Duplicates

Field duplicates will be submitted at the rate of one for every ten samples per matrix. Field personnel will note on the sample summary form and in the logbook which samples are field duplicates. Duplicate samples will be shipped blind to the laboratories, and shipping paperwork will be completed accordingly.

Field duplicates are collected by mixing a double or triple portion of the required volume of sample and dividing it into two sample containers. Field duplicates provide precision information regarding homogeneity, handling, shipping, storing, preparation, and analysis.

### 4.1.2.2 Rinsate Blanks

Rinsate blanks are obtained under representative field conditions by running analyte-free deionized water through sample collection equipment after decontamination, immediately before sampling and placing it in the appropriate sample containers for analysis. These samples are used to assess the effectiveness of decontamination procedures. Rinsate blanks will be prepared at the rate of one per day during the sampling event. All rinsate samples will be sent to the laboratory, with instructions to the laboratory to "hold" every other sample (to be analyzed only if necessary based on results of previous rinsate blanks).

### 4.1.2.3 Field Blanks

Field blanks will consist of the source water used in decontamination (includes analyte-free deionized water, potable water from each source, and other waters used in decontamination operations). Field blanks will be prepared at the rate of one per source of water per sampling event.

# 4.1.2.4 Matrix Spike/Matrix Spike Duplicates

A matrix spike sample will be identified by field teams at a frequency of 1 in 20 field samples (per matrix) collected. Samples for matrix spike analyses and laboratory duplicate analysis are collected in triplicate volumes for aqueous organics (three containers for each analyte group), and duplicate volumes for aqueous metals (two containers). Soil matrix spikes will be collected in double volumes.

# 4.2 SAMPLING PROCEDURES

Field sampling will be conducted in accordance with Section 3.0 of this document and the TtNUS SOPs presented in Appendix A. Allowable sample holding times and preservation requirements are shown in Table 3-2.

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4.3 **SAMPLE DESIGNATION AND CUSTODY** 

This section describes the sample designation and chain-of-custody requirements for all environmental

and quality control samples.

4.3.1 **Environmental Samples** 

Each sample collected will be assigned a unique sample tracking number that will be sued to catalog the

results of the EGIS database system for NSN. The sample tracking number will consist of alpha-numeric

characters identifying the site, sample medium, location, and depth. Any other pertinent information

regarding sample identification will be recorded on the sample logsheets or in the field logbooks.

The alpha-numeric coding to be used in the sample system is detailed below and in the subsequent

definitions.

AAA AA - (NNN)

- (NNNN)

(Site ID) -

(Medium)

- (Location)

- (Depth)

Site identifier: "OFF" for OFFTA

Medium identifier:

"SD" for sediment samples collected from cores;

Sample location identifier: each sample location will be assigned a consecutive number in order of

advancement, using 400-series identifiers (e.g. -400, -401, etc.).

Depth: This portion of the sample tracking number will represent the depth in inches below ground

surface from which the sample was collected, e.g., for sediment samples collected from 0 to 6 inches

below ground surface, this portion of the sample tracking number will be "0006", and samples collected

from 12 to 18 inches below ground surface, the portion of the tracking number will be "1218", etc.

Examples:

A sediment sample collected from boring number 412 at a depth of 0 to 6 inches will be identified as OFF-

SD-412-0006.

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**Quality Control (QC) Samples** 

Field quality control (QC) samples will use the same coding system as for environmental samples. Field QC sample types are described in Section 4.1.2.

Blind duplicate samples will be designated such that the location designation will be replaced with a chronological number. The sample log sheet will note which sample location the duplicate was collected

from:

Duplicates:

OFF-DUP##

Field blanks will be designated such that they can clearly be identified as field blanks. The designation must be able to be referenced to the source, i.e. DIUF water, potable water (PTW), etc., using the field sample data forms.

Field Blanks:

OFF-DIUF-FB##

OFF-PTW-FB##

Rinsate blanks will be identified using the code for the sample for which the sampling device or tool was last used, the identifier (RB), and its chronological number.

Rinsate Blanks:

OFF-SD-404-RB##

Matrix spike samples have no separate sample identifier codes, but are noted on the chain-of-custody record and sample logsheet.

4.3.2 <u>Sample Chain of Custody</u>

Custody of samples must be maintained and documented at all times. To ensure the integrity of a sample from collection through analysis, an accurate written record is necessary to trace the possession and handling of the sample. This documentation is referred to as the "chain of custody". Chain of custody begins when samples are collected in the field, and is maintained by storing the samples in secure areas until custody can be passed on. A chain-of-custody form that lists each sample, the analytical parameters, and the persons who are responsible for their integrity will accompany all samples (an example form is included in Appendix B).

Samples will be placed on ice and attended by TtNUS personnel or placed in locked vehicles or designated storage areas until analysis or shipment to an off-site laboratory. Chain-of-custody

procedures are described in further detail in the SOPs.

# 4.4 CALIBRATION PROCEDURES

Field equipment normally requiring calibration will be calibrated and operated in accordance with the manufacturer's instructions and manuals. A log will be kept on site, documenting the periodic calibration results for each field instrument.

Calibration procedures for laboratory equipment used in the analysis of environmental samples will be performed in accordance with NFESC requirements and contract requirements under the Basic Ordering Agreements (BOA).

# 4.5 LABORATORY ANALYSIS

Samples will be analyzed for various parameters as described in previous sections and in Table 3-1.

A laboratory previously approved by the Navy will analyze the environmental samples collected for laboratory analysis during the field investigation. Standard EPA analytical procedures will be employed, as depicted in Table 3-2.

# 4.6 DATA REDUCTION, VALIDATION, AND REPORTING

Laboratory analytical data will be reviewed by qualified TtNUS technical staff, according to EPA-equivalent "Tier II" protocols. A data review memorandum will be prepared and submitted to the project manager as a part of that activity. Data review procedures are described in Section 4.10.

Field data will be periodically reviewed by technical lead personnel and the TtNUS PM to ensure that the data collected are well documented, clearly described, and meet a standard appropriate for the investigation and its ultimate use.

# 4.7 INTERNAL QUALITY CONTROL

Section 4.1.2 discussed the types and frequency of quality control samples that will be prepared during the field investigation activities for those samples that undergo laboratory analysis. The quantities of various types of QC samples are shown in Table 3-1. Laboratory analysis will follow the QC criteria described in the analytical procedures.

### 4.8 PERFORMANCE AND SYSTEM AUDITS

System audits will be performed as appropriate to ensure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The TtNUS Field Operations Leader (FOL) will supervise and on a daily basis check to ensure that the equipment is properly decontaminated, samples are collected and handled properly, and the fieldwork is accurately and neatly documented.
- The data reviewer(s) will review the data to ensure they were obtained through the approved methodology, and that the appropriate level of QC effort and reporting were conducted. The data review effort will be supervised by the TtNUS CLEAN Quality Assurance Manager or designee.
- The Project Manager (PM) will oversee the FOL and data reviewer, and check that management
  of the acquired data proceeds in an organized and expeditious manner.

# 4.9 PREVENTATIVE MAINTENANCE

TtNUS has established a field equipment maintenance program to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The equipment manager maintains an inventory of the equipment by model and serial number, quantity, and condition. Each item of equipment is signed out when in use and its operating condition and cleanliness is checked upon return.
- The equipment manager conducts routine checks on the status of equipment and is responsible for stocking spare parts and for equipment readiness.
- The equipment manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.
- The FOL is responsible for working with the equipment manager to ensure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.

 While the equipment is in the field, the FOL or designee is responsible for the equipment, maintains calibration records, and performs maintenance operations and checks.

# 4.10 DATA ASSESSMENT PROCEDURES

The following paragraphs describe the procedures used to evaluate data prior to inclusion in deliverable reports.

# 4.10.1 Representativeness, Accuracy, and Precision

All laboratory data generated in the investigation will be assessed for representativeness, accuracy, and precision, as described in Section 4.1. The completeness of the data will also be assessed by comparing the acquired data to the project objectives to see that these objectives are being addressed and met.

Qualified TtNUS personnel will conduct the PARCC parameter assessment. Determining if the data are consistent with known or anticipated chemical conditions and accepted principles will assess the representativeness of the data.

Field measurements will be checked for completeness of procedures and documentation of procedures and results.

Precision and accuracy will be determined using duplicate samples, and blank and spiked samples, respectively. PARCC parameters are addressed in more detail in Section 4.1.

# 4.10.2 Analytical Data Review

An analytical data review process that includes the following tasks will be carried out:

- Check data for completeness to determine if all samples were analyzed and reported for the parameters requested in the chain-of-custody form.
- Check data report for accuracy of sample identification, sample location, collection date, and units.
- Organize the data tables by sample matrix, sample location, and calculate and report the average
  of field duplicate results. Consolidate results of two sample dilutions into one set of results.

- Check large positive hits against the raw data to avoid false positive results.
- Submit the data review results with a summary of problems and resolutions in writing.

# 4.11 CORRECTIVE ACTION

The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve non-conformance with the SOPs and/or analytical procedures established for the project, or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the FOL and the PM. The PM, with the assistance of the Quality Assurance Manager and the project QA/QC officer, will be responsible for developing and initiating appropriate corrective action and verifying that the corrective action has been effective.

Corrective actions may include re-sampling and/or re-analysis of samples or modifying project procedures. If warranted by the severity of the problem (for example, if a change in the approved work plan is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change. Additional work that depends on a nonconforming activity will not be performed until the source of the problem has been addressed.

# 4.12 QUALITY ASSURANCE REPORTS/DOCUMENTS

A bound/weatherproof field logbook will be maintained by the FOL. The FOL or designee will record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events, field measurements, photograph description, etc. The site logbook maintained by the FOL will contain a summary of the day's activities and will reference the other field logbooks when applicable.

At the completion of field activities, the FOL will submit to the PM all field records, data, field logbooks, chain-of-custody receipts, sample logsheets, etc. The PM will ensure that these materials are entered into the project file. Examples of forms to be used in the field are included in Appendix B.

# APPENDIX A STANDARD OPERATING PROCEDURES



# STANDARD OPERATING PROCEDURES

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Applicability

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Prepared

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Subject

SURFACE WATER AND SEDIMENT SAMPLING

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### 1.0 PURPOSE

This procedure describes methods and equipment commonly used for collecting environmental samples of surface water and aquatic sediment for either onsite examination and chemical testing, or for subsequent laboratory analysis.

### 2.0 SCOPE

The information presented in this guideline is generally applicable to all environmental sampling of surface waters (Section 5.3) and aquatic sediments (Section 5.5), except where the analyte(s) may interact with the sampling equipment. The collection of concentrated sludges or hazardous waste samples from disposal or process lagoons often requires methods, precautions and equipment different from those described herein.

### 3.0 GLOSSARY

<u>Environmental Sample</u> - a sample containing (or suspected to contain) low-level concentrations of contaminants, which does not require special handling or transport considerations as detailed in SOP SA-6.1.

<u>Hazardous Waste Sample</u> - a sample containing (or suspected to contain) higher concentrations of contaminants thus requiring special handling and/or transport considerations per SOP SA-6.1.

### 4.0 RESPONSIBILITIES

<u>Project Manager</u> - The Project Manager has the overall responsibility for seeing that all surface water and sediment sampling activities are properly conducted by appropriately trained personnel.

<u>Field Operations Leader</u> - The Field Operations Leader (FOL) is responsible for the in-field supervision of the conduct of onsite water quality analyses, ensuring the completion and accuracy of all field documentation, and making sure that custody of all samples obtained is maintained according to proper procedures.

### 5.0 PROCEDURES

### 5.1 Introduction

Collecting a representative sample from surface water or sediments is difficult because of water movement, stratification, or patchiness. To collect representative samples, one must standardize sampling bias related to site selection, sampling frequency, sample collection, sampling devices, and sample handling, preservation, and identification.

Representativeness is a qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been taken. Regardless of quality control applied during laboratory analyses and subsequent scrutiny of analytical data packages, reported data are no better than the confidence that can be placed in the representativeness of the samples.

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#### 5.2 Defining the Sampling Program

Many factors must be considered in developing a sampling program for surface water or sediments including study objectives, accessibility, site topography, physical characteristics of the water body (such as flow and mixing), point and diffuse sources of contamination, and personnel and equipment available to conduct the study. For waterborne constituents, dispersion depends on the vertical and lateral mixing within the body of water. For sediments, dispersion depends on bottom current or flow characteristics, sediment characteristics (density, size) and geochemical properties (which affect adsorption/desorption). The hydrogeologist developing the sampling plan must therefore know not only the mixing characteristics of streams and lakes, but also must understand the role of fluvial-sediment transport, deposition, and chemical sorption.

#### 5.2.1 Sampling Program Objectives

The objective of surface water sampling is to determine the surface water quality entering, leaving or remaining within the site. The scope of the sampling program must consider the sources and potential pathways for transport of contamination to or within a surface water body. Sources may include point sources (leaky tanks, outfalls, etc.) or nonpoint sources (e.g., spills). The major pathways for surface water contamination (not including airborne deposition) are overland runoff, leachate influx to the waterbody, direct waste disposal (solid or liquid) into the water body; and groundwater flow influx from upgradient. The relative importance of these pathways, and therefore the design of the sampling program, is controlled by the physiographic and hydrologic features of the site, the drainage basin(s) which encompass the site, and the history of site activities.

Physiographic and hydrologic features to be considered include slopes and runoff direction, areas of temporary flooding or pooling, tidal effects, artificial surface runoff controls such as berms or drainage ditches (and when they were constructed relative to site operation), and locations of springs, seeps, marshes, etc. In addition, the obvious considerations such as the location of man-made discharge points to the nearest stream (intermittent or flowing), pond, lake, estuary, etc., shall be considered.

A more subtle consideration in designing the sampling program is the potential for dispersion of dissolved or sediment-associated contaminants away from the source. The dispersion could lead to a more homogeneous distribution of contamination at low or possibly non-detectable concentrations. Such dispersion does not, however, always readily occur. For example, obtaining a representative sample of contamination from a main stream immediately below an outfall or a tributary is difficult because the inflow frequently follows a stream bank with little lateral mixing for some distance. Sampling alternatives to overcome this situation are: (1) move the site far enough downstream to allow for adequate mixing, or (2) collect integrated samples in a cross section. Also, nonhomogeneous distribution is a particular problem with regard to sediment-associated contaminants, which may accumulate in low-energy environments (coves, river bends, deep spots, or even behind boulders) near or distant from the source while higher-energy areas (main stream channels) near the source may show no contaminant accumulation.

The distribution of particulates within a sample itself is an important consideration. Many organic compounds are only slightly water soluble and tend to adsorb onto particulate matter. Nitrogen, phosphorus, and the heavy metals may also be transported by particulates. Samples must be collected with a representative amount of suspended material; transfer from the sampling device shall includ transferring a proportionate amount of the suspended material.

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#### 5.2.2 Location of Sampling Stations

Accessibility is the primary factor affecting sampling costs. The desirability and utility of a sample for analysis and consideration of site conditions must be balanced against the costs of collection as controlled by accessibility. Bridges or piers are the first choice for locating a sampling station on a stream, because bridges provide ready access and also permit the sampling technician to sample any point across the stream. A boat or pontoon (with an associated increase in cost) may be needed to sample locations on lakes and reservoirs, as well as those on larger rivers. Frequently, however, a boat will take longer to cross a water body and will hinder manipulation of the sampling equipment. Wading for samples is not recommended unless it is known that contaminant levels are low so that skin contact will not produce adverse health effects. This provides a built in margin of safety in the event that wading boots or other protective equipment should fail to function properly. If it is necessary to wade into the water body to obtain a sample, the sampler shall be careful to minimize disturbance of bottom sediments and must enter the water body downstream of the sampling location. If necessary, the sampling technician shall wait for the sediments to settle before taking a sample

Sampling in marshes or tidal areas may require the use of an all-terrain vehicle (ATV). The same precautions mentioned above with regard to sediment disturbance apply.

Under ideal and uniform contaminant dispersion conditions in a flowing stream, the same concentrations of each would occur at all points along the cross section. This situation is most likely downstream of areas of high turbulence. Careful site selection is needed in order to ensure, as nearly as possible, that samples are taken where uniform flow or deposition and good mixing conditions exist.

The availability of streamflow and sediment discharge records can be an important consideration in choosing sampling sites in streams. Streamflow data in association with contaminant concentration data are essential for estimating the total contaminant loads carried by the stream. If a gaging station is not conveniently located on a selected stream, the project hydrogeologist shall explore the possibility of obtaining streamflow data by direct or indirect methods.

#### 5.2.3 Frequency of Sampling

The sampling frequency and the objectives of the sampling event will be defined by the project plan documents. For single-event site or area characterization sampling, both bottom material and overlying water samples shall be collected at the specified sampling stations. If valid data are available on the distribution of the contaminant between the solid and aqueous phases, it may be appropriate to sample only one phase, although this is not often recommended. If samples are collected primarily for monitoring purposes (i.e., consisting of repetitive, continuing measurements to define variations and trends at a given location), water samples shall be collected at a pre-established and constant interval as specified in the project plans (often monthly or quarterly, and during droughts and floods). Samples of bottom material shall be collected from fresh deposits at least yearly, and preferably seasonally, during both spring and fall.

The variability in available water-quality data shall be evaluated before determining the number and collection frequency of samples required to maintain an effective monitoring program.

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# 5.3 Surface Water Sample Collection

# 5.3.1 Streams, Rivers, Outfalls and Drainage Features (Ditches, Culverts)

Methods for sampling streams, rivers, outfalls, and drainage features at a single point vary from the simplest of hand-sampling procedures to the more sophisticated multi-point sampling techniques known as the equal-width-increment (EWI) method or the equal-discharge-increment (EDI) methods (see below).

Samples from different depths or cross-sectional locations in the watercourse taken during the same sampling episode, shall be composited. However, samples collected along the length of the watercourse or at different times may reflect differing inputs or dilutions and therefore shall not be composited. Generally, the number and type of samples to be taken depend on the river's width, depth, discharge and on the suspended sediment the stream or river transports. The greater the number of individual points that are sampled, the more likely that the composite sample will truly represent the overall characteristics of the water.

In small streams less than about 20 feet wide, a sampling site can generally be found where the water is well mixed. In such cases, a single grab sample taken at mid-depth in the center of the channel is ad quate to represent the entire cross section.

For larger streams, at least one vertical composite shall be taken with one sample each from just below the surface, at mid-depth, and just above the bottom. The measurement of DO, pH, temperature, conductivity, etc., shall be made on each aliquot of the vertical composite and on the composite itself. For rivers, several vertical composites shall be collected, as directed in the project plan documents.

#### 5.3.2 Lakes, Ponds and Reservoirs

Lakes, ponds, and reservoirs have a much greater tendency to stratify than rivers and streams. The relative lack of mixing requires that more samples be obtained.

The number of water sampling sites on a lake, pond, or impoundment will vary with the size and shape of the basin. In ponds and small lakes, a single vertical composite at the deepest point may be sufficient. Similarly, the measurement of DO, pH, temperature, etc., is to be conducted on each aliquot of the vertical composite and on the composite itself. In naturally-formed ponds, the deepest point may have to be determined empirically; in impoundments, the deepest point is usually near the dam.

In lakes and larger reservoirs, several vertical composites shall be composited to form a single sample. These verticals are often taken along a transect or grid. In some cases, it may be of interest to form separate composites of epilimnetic and hypolimnetic zones. In a stratified lake, the epilimnion is the thermocline which is exposed to the atmosphere. The hypolimnion is the lower, "confined" layer which is only mixed with the epilimnion and vented to the atmosphere during seasonal "overturn" (when density stratification disappears). These two zones may thus have very different concentrations of contaminants if input is only to one zone, if the contaminants are volatile (and therefore vented from the epilimnion but not the hypolimnion), or if the epilimnion only is involved in short-term flushing (i.e., inflow from or outflow to shallow streams). Normally, however, a composite consists of several verticals with samples collected at various depths.

In lakes with irregular shape and with bays and coves that are protected from the wind, separate composite samples may be needed to adequately represent water quality since it is likely that only poor mixing will occur. Similarly, additional samples are recommended where discharges, tributaries, land use characteristics, and other such factors are suspected of influencing water quality.

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Many lake measurements are now made in-situ using sensors and automatic readout or recording devices. Single and multi-parameter instruments are available for measuring temperature, depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, some cations and anions, and light penetration.

#### 5.3.3 Estuaries

Estuarine areas are by definition, zones where inland freshwaters (both surface and ground) mix with oceanic saline waters. Estuaries are generally categorized into three types dependent upon freshwater inflow and mixing properties. Knowledge of the estuary type is necessary to determine sampling locations. Each type of estuarine area is described below:

- Mixed Estuary characterized by the absence of a vertical halocline (gradual or no marked increase
  in salinity in the water column) and a gradual increase in salinity seaward. Typically this type of
  estuary is shallow and is found in major freshwater sheetflow areas. Being well mixed, the sampling
  locations are not critical in this type of estuary.
- Salt Wedge Estuary characterized by a sharp vertical increase in salinity and stratified freshwater flow along the surface. In these estuaries, the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally, back and forth, with the tidal phase. If contamination is being introduced into the estuary from upstream, water sampling from the salt wedge may miss it entirely.
- Oceanic Estuary characterized by salinities approaching full-strength oceanic waters. Seasonally, freshwater inflow is small with the preponderance of the fresh-saline water mixing occurring near, or at, the shore line.

Sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides (i.e., when the tide turns). Estuarine sampling programs shall include vertical salinity measurements at 1- to 5-foot increments, coupled with vertical dissolved oxygen and temperature profiles.

#### 5.3.4 Surface Water Sampling Equipment

The selection of sampling equipment depends on the site conditions and sample type to be acquired. The most frequently used samplers are:

- Open tube.
- Dip sampler.
- Weighted bottle.
- Hand pump.
- Kemmerer.
- Depth-Integrating Sampler.

The dip sampler and the weighted bottle sampler are used most often, and detailed discussions for these devices only (and the Kemmerer sampler) are addressed subsequently in this section.

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The criteria for selecting a sampler include:

- 1. Disposability and/or easy decontamination.
- 2. Inexpensive cost (if the item is to be disposed).
- 3. Ease of operation.
- 4. Nonreactive/noncontaminating properties Teflon-coated, glass, stainless-steel or PVC sample chambers are preferred (in that order).

As specified in the project plan document plan documents, each sample (grab or each aliquot collected for compositing) shall be measured for:

- Specific conductance.
- Temperature.
- pH.
- Dissolved oxygen (optional).

Sample measurements shall be conducted as soon as the sample is acquired. Measurement techniques described in SOP SA-1.1 shall be followed. All pertinent data and results shall be recorded in a field notebook or on sample logsheets (see SOP SA-6.3). These analyses will provide information on water mixing/stratification and potential contamination.

### **Dip Sampling**

Water is often sampled by filling a container either attached to a pole or held directly, from just beneath the surface of the water (a dip or grab sample). Constituents measured in grab samples are only indicative of conditions near the surface of the water and may not be a true representation of the total concentration that is distributed throughout the water column and in the cross section. Therefore, whenever possible, it is recommended to augment dip samples with samples that represent both dissolved and suspended constituents and both vertical and horizontal distributions.

#### Weighted Bottle Sampling

A grab sample can also be taken using a weighted holder that allows a bottle to be lowered to any desired depth, opened for filling, closed, and returned to the surface. This allows discrete sampling with depth. Several of these samples can be combined to provide a vertical composite. Alternatively, an open bottle can be lowered to the bottom and raised to the surface at a uniform rate so that the bottle collects sample throughout the total depth and is just filled on reaching the surface. The resulting sample using either method will roughly approach what is known as a depth-integrated sample.

A closed weighted bottle sampler consists of a stopped glass or plastic bottle, a weight and/or holding device, and lines to open the stopper and lower or raise the bottle. The procedure for sampling with this device is:

- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely (watch for bubbles).
- Pull out the stopper with a sharp jerk of the stopper line.
- Allow the bottle to fill completely, as evidenced by the absence of air bubbles.
- Raise the sampler and cap the bottle.

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• Decontaminate the outside of the bottle This bottle can be used as the sample container as long as the bottle is an approved container type.

#### Kemmerer

If samples are desired at a specific depth, and the parameters to be measured do not require a Teflon coated sampler, a standard Kemmerer sampler may be used. The Kemmerer sampler is a brass, stainless-steel or acrylic cylinder, with rubber stoppers that leave the ends open while being lowered in a vertical position (thus allowing free passage of water through the cylinder). A "messenger" is sent down the line when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill sample bottles.

#### 5.3.5 Surface Water Sampling Techniques

Most samples taken during site investigations are grab samples. Typically, surface water sampling involves immersing the sample container in the body of water; however, the following suggestions are made to help ensure that the samples obtained are representative of site conditions:

- The most representative samples are obtained from mid-channel at a 0.6 foot stream depth in a well-mixed stream.
- Even though the containers used to obtain the samples are previously laboratory cleaned, it is suggested that the sample container be rinsed at least once with the water to be sampled before the sample is taken. This is not applicable when sample containers are provided "pre-preserved."
- For sampling running water, it is suggested that the farthest downstream sample be obtained first, and that subsequent samples be taken as one works upstream. In general, work from zones suspected of low contamination to zones of high contamination.
- To sample a pond or other standing body of water, the surface area may be divided into grids. A
  series of samples taken from each grid node is combined into one sample, or several grid nodes are
  selected at random.
- Care should be taken to avoid excessive agitation of the water, as loss of volatile constituents could result.
- When obtaining samples in 40 mL septum vials for volatile organics analysis, it is important to exclude
  any air space in the top of the bottle and to be sure that the Teflon liner of the septum faces in after
  the vial is filled and capped. The vial can be turned upside down to check for air bubbles.
- Do not sample at the surface, unless sampling specifically for a known constituent which is immiscible
  and on top of the water. Instead, the sample container should be inverted, lowered to the
  approximate depth, and held at about a 45-degree angle with the mouth of the bottle facing upstream.
  When sample containers are provided "pre-preserved," use a dedicated, clean, un-preserved bottle
  for sampling and transfer to an appropriately-preserved container.

### 5.4 Onsite Water Quality Testing

Onsite water quality testing shall be conducted as described in SOP SA-1.1.

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### 5.5 Sediment Sampling

#### 5.5.1 General

Sediment samples are usually collected at the same verticals at which water samples were collected. If only one sediment sample is to be collected, the sampling location shall be approximately at the center of the water body.

G n rally, the coarser grained sediments are deposited near the headwaters of the reservoir. Bed sediments near the center of a water body will be composed of fine-grained materials which may, because of their lower porosity and greater surface area available for adsorption, contain greater concentrations of contaminants. The shape, flow pattern, bathometry (i.e., depth distribution), and water circulation patterns must all be considered when selecting sediment sampling sites. In streams, areas likely to have sediment accumulation (e.g., bends, behind islands or boulders, quiet shallow areas or very deep, low-velocity areas) shall be sampled white areas likely to show net erosion (i.e., high-velocity, turbulent areas) and suspension of fine solid materials, shall be avoided.

Chemical constituents associated with bottom material may reflect an integration of chemical and biological processes. Bottom samples reflect the historical input to streams, lakes, and estuaries with respect to time, application of chemicals, and land use. Bottom sediments (especially fine-grained material) may act as a sink or reservoir for adsorbed heavy metals and organic contaminants (even if water column concentrations are below detection limits). Therefore, it is important to minimize the loss of low-density "fines" during any sampling process.

All relevant information pertaining to sediment sampling shall be documented as applicably described in SOP SA-6.3.

#### 5.5.2 Sampling Equipment and Techniques

A bottom-material sample may consist of a single scoop or core, or may be a composite of several individual samples in the cross section. Sediment samples may be obtained using onshore or offshore techniques.

When boats are used for sampling, life preservers must be provided and two individuals must undertake the sampling. An additional person shall remain onshore in visual contact at all times.

The following samplers may be used to collect bottom materials:

- Scoop sampler.
- Dredge samplers.

Each type of sampler is discussed subsequently

#### Scoop Sampler

A scoop sampler consists of a pole to which a jar or scoop is attached. The pole may be made of bamboo, wood or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is usually attached using a clamp.

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If the water body can be sampled from the shore or if it can be waded, the easiest and best way to collect a sediment sample is to use a scoop sampler. This reduces the potential for cross-contamination. This method is accomplished by reaching over or wading into the water body and, while facing upstream (into the current), scooping the sampler along the bottom in the upstream direction. It is very difficult not to disturb fine-grained materials of the sediment-water interface when using this method.

#### **Dredges**

Dr dges are generally used to sample sediments which cannot easily be obtained using coring devices (i.e., coarse-grained or partially-cemented materials) or when large quantities of sample are required. Dredges generally consist of a clam shell arrangement of two buckets. The buckets may either close upon impact or be activated by use of a "messenger". Most dredges are heavy (up to several hundred pounds) and require use of a winch and crane assembly for sample retrieval. There are three major types of dredges: Peterson, Eckman and Ponar dredges.

The Peterson dredge is used when the bottom is rocky, in very deep water, or when the flow velocity is high. The Peterson dredge shall be lowered very slowly as it approaches bottom, because it can force out and miss lighter materials if allowed to drop freely.

The Eckman dredge has only limited usefulness—It performs well where bottom material is unusually soft, as when covered with organic sludge or light mud. It is unsuitable, however, for sandy, rocky, and hard bottoms and is too light for use in streams with high flow velocities.

The Ponar dredge is a Peterson dredge modified by the addition of side plates and a screen on the top of the sample compartment. The screen over the sample compartment permits water to pass through the sampler as it descends thus reducing the "shock wave" and permitting direct access to the secured sample without opening the closed jaws. The Ponar dredge is easily operated by one person in the same fashion as the Peterson dredge. The Ponar dredge is one of the most effective samplers for general use on all types of substrates.

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TETRA TECH NUS, INC.

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Applicability

Tetra Tech NUS, Inc.

Prepared

Earth Sciences Department

Approved

D. Senovich

Subject

FIELD DOCUMENTATION

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#### 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

#### 2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

#### 3.0 GLOSSARY

None

#### 4.0 RESPONSIBILITIES

<u>Project Manager (PM)</u> - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

<u>Field Operations Leader (FOL)</u> - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

#### 5.0 PROCEDURES

#### 5.1 Site Logbook

#### 5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

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The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- · Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

#### 5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

#### 5.2 <u>Field Notebooks</u>

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

#### 5.3 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon client

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approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

# 5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

#### 5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

#### 5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

#### 5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager, while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

### 5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

### 5.3.1.5 Field Analytical Log Sheets for Geochemical Parameters

Field Analytical Log Sheets (Attachment B-8) are used to record geochemical and/or natural attenuation field test results. Attachments B-8 (3-page form) should be used when applicable.

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#### 5.3.2 Hydrogeological and Geotechnical Forms

#### 5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out for each round of water level measurements made at a site.

#### 5.3.2.2 <u>Data Sheet for Pumping Test</u>

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

#### 5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted.

### 5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log, (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these results must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

# 5.3.2.5 <u>Monitoring Well Construction Details Form</u>

A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions.

### 5.3.2.6 <u>Test Pit Log</u>

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

# 5.3.2.7 <u>Miscellaneous Monitoring Well Forms</u>

Monitoring Well Materials Certificate of Conformance (Attachment C-11) should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record (Attachment C-12) should be used as the project directs to document all well development activities.

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### 5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

#### 5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

#### 5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

#### 5.4.1.1 <u>Description</u>

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

#### 5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

#### 5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

#### 5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

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It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required. Attachment F is an example of a Field Trip Summary Report form.

# 6.0 ATTACHMENTS

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Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment B-8	FIELD ANALYTICAL LOG SHEET
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN
	BEDROCK
Attachment C-9	EXAMPLE BEDROCK MONITORING WELL SHEET -
	WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-10	EXAMPLE TEST PIT LOG
Attachment C-11	MONITORING WELL MATERIALS CERTIFICATE OF CONFORMANCE
Attachment C-12	MONITORING WELL DEVELOPMENT RECORD
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	
Attachment F	FIELD TRIP SUMMARY REPORT

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# ATTACHMENT A TYPICAL SITE LOGBOOK ENTRY

SITE LEA	ADER:		
PERSON		DRILLER	SITE VISITORS
WEATH	ER: Clear, 68°F, 2-5 mph wir	nd from SE	
ACTIVITI	ES:		
1.	Steam jenney and fire hose	es were set up.	
2.	see sample logbook, page 25	9-30, for details of drilling activity ge 42.  Drilling activities complet	. See Geologist's c. Sample No. 123-21-S4 collected ted at 11:50 and a 4-inch stainless ge 31, and well construction details
3.	well		it. Then set up at location of
4.	No. 2, page for det	eologist was tails of drilling activities. Sampl see sample logbook, pages 43,	See Geologist's Notebook le numbers 123-22-S1, 123-22-S2 44, and 45.
5.	Well was developed was then pumped using from well was "sand free.	the pitcher pump for 1 hour. At	illed in the flushing stage. The well the end of the hour, water pumped
6.	EPA remedial project many	ger arrives on site at 14:25 hours	i.
7.	Large dump truck arrives over test pit	at 14:45 and is steam-cleaned.	Backhoe and dump truck set up
8.	Se activities. Test pit subse	e Geologist's Notebook, No.1 equently filled. No samples tak le, filling in of test pit resulte	np truck. Rig geologist was , page 32, for details of test pit en for chemical analysis. Due to ed in a very soft and wet area. A
9.	Express carrier picked to 17:50 hours. Site activities	up samples (see Sample Lo es terminated at 18:22 hours. All	gbook, pages 42 through 45) at personnel off site, gate locked.
	-	Field Operations Leader	

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Desired Site Names					Sample	ID No :	- · · - · - ·	
Project Site Name: Project No.:						Location:		
1 1 19,000 1 10.11					Sample	d By:		
[] Domestic Well Data					C.O.C.			
Monitoring Well Data					Type of	Sample:		
① Other Well Type: ② QA Sample Type:		[] Low Concentre				uion ation		
SAMPLING DATAREMANDERPH	<b>通報和的加盟</b>	引擎機制	部裡相關信	特加國加州				
Date:	Color	pН	s.c.	Temp.	Turbidity	DO	Salinity	Other
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(96)	
Method: PURGE DATA(())	Marie Company	odenie jaka je obraklev		numery, som in b		ALIO MALINA DE LA DOSA		
	Volume		S.C.	Temp.	Turbidity	DO	Salinity	Other
Date -	volume	рH	S.C.	remp.	Toroidny	<del>  100                                  </del>	Santity	Outer
Method:	-	<del>                                     </del>	<del> </del>		<del></del>	<b></b>		
Monitor Reading (ppm):								
Well Casing Diameter & Material			-			<del></del>	<del></del>	
Type:			<del>                                     </del>				<u> </u>	
Total Well Depth (TD):		<b></b> -					<del>                                     </del>	
Static Water Level (WL):	<del> </del>	<u> </u>	<del>                                     </del>	<del> </del>	<del>                                     </del>		<del> </del>	<del>                                     </del>
One Casing Volume(gal/L): Start Purge (hrs):		<del> </del>	<del> </del>	<del> </del>	<del>                                     </del>	1	1	<del>                                     </del>
End Purge (hrs):	<del>                                     </del>	<b></b>			<u> </u>			
Total Purge Time (min):	<del>                                     </del>				<del>                                     </del>			
Total Vol. Purged (gal/L):	<b>†</b>	<del> </del>	<del>                                     </del>	<del></del>				
SAMPLE COLLECTION INFORMA	TION: IIIIII	ALEY TANK	11月11日		Belleville Mark			EMPLEMENT SE
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OBSERVATIONS!/ NOTEBUILDE		<b>LANGE</b>	資料排物製				<b>洲海科斯</b> 斯斯	和對於關係
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	Page of  Sample ID No.: Sample Location: Sampled By: C.O.C. No.:  Type of Sample: [] Low Concentration [] High Concentration  Page of  Type of Sample: [] Low Concentration [] High Concentration  Concentration  Container Requirements  Collected
Project Site Name: Project No.:  [] Stream [] Spring [] Pond [] Lake [] Other: [] QA Sample Type:  SAMPLING DATASHALL AND SAMPLE (S.U.) (mS/cm)  Depth: Method:  Analysis  Preservative	Page of  Sample ID No.: Sample Location: Sampled By: C.O.C. No.:  Type of Sample: [] Low Concentration [] High Concentration  Page of  Type of Sample: [] Low Concentration [] High Concentration  Concentration  Container Requirements  Collected
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[] Pond [] Lake [] Other: [] QA Sample Type:  SAMPLING DATA	Low Concentration
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Date: Color pH S.C. Te Time: (Visual) (S.U.) (mS/cm)  Depth: Method:  SAMPLE COLLECTION INFORMATION III	Turbidity DO Salinity Other (NTU) (mg/I) (%)  Container Requirements  Collected
Time: (Visual) (S.U.) (mS/cm)  Depth: Method:  SAMPLE COLLEGION INFORMATION	Container Requirements  Container Requirements
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			ATTACHMEN	IT B-3		
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Project Site Nai Project No.:  [] Surface Si [] Subsurfac [] Sediment [] Other: [] QA Sampl	oil e Soil e Type:		CANAGE PROPERTY OF STATE OF ST	High C	cation:  y: :	KUTUKA KELANGGAN
Date:	TO SHIP STANDARD	Depth Interval	Color		(Sand, Silt, Clay, Mo	
lme:		,	<del>.</del>	1	· · · · · · · · · · · · · · · · · · ·	
fethod:						
Monitor Reading (pp				1		
OMPOSITEISAMP	LE DATA:	<b>操作作品和对外的信仰</b> 而是	<b>新疆国和川川山東</b> 林	<b>洲洲洲洲</b>		開業場制作
Date:	Time	Depth Interval	Color	Description	(Sand, Silt, Clay, Mo	isture, etc.)
Method:		-				
Monitor Readings Range in ppm):						
					<u></u>	
AMPLE COULECT	IONINFORMA	TION: HARMANIAN				
SAMPLECOULECT	IONINFORMA Analysis		Durstimentalistic		Collected	Other
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	Analysis		Container Rec	quirements	Collected	Other
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# ATTACHMENT B-4

Tetra Tech NUS, Inc.	Page of
Project Site Name: Project Number: Site Identification: Container Number(s): Sample Type: () Grab () Composite	Sample ID No Sampled By: C.O.C. No Concentration: () High () Medium
CONTAINER SOURCE	0 Low CONTAINER DESCRIPTION
DRUM:  () Bung Top () Lever Lock () Botted Ring () Other	COLOR:
TANK:  O Plastic O Metal O Other	MARKINGS:
OTHER:	OTHER:
EGONTAINER DISPOSITION	THE CONENG THE
SAMPLED:	SINGLE PHASED:
OPENED BUT NOT SAMPLED: Reason	MULTIPHASE: Layer 1 Layer 2 Layer 3
NOT OPENED: Reason	Phase (Sol. or Liq.)  Color  Viscosity  L, M or H, L, M or H, L, M or H % of Total Volume
MONITOR READING TO THE	SAMPLE CINCLYOF INSPECTION DATE & TIME HRS.  HRS.
SAMPLER(5) and / or	TETELETERE TETELETERANALYSISTER TO THE TETELETERE

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# **ATTACHMENT B-5**

TŁ	Tetra Tech ( 661 Anders Pittsburgh, (412)921-70	en Drive 15220	Project: Site: Location:		
Sample N	lo:			Matrix:	
Date:		Time:	Preserv	e:	
Analysis	•				
Sampled by:		Laborato	ory:		

ROJECT NO:	SITE NAME	1				NUMBER					Y NAME A	AND CON	ITACT:				;
AMPLERS (SIGNATURE)				BILL NUN		PHONE	NUMBER			RESS Y, STATE						OCOM	<u> </u>
FANDARD TAT DUSH TAT	72 hr.		60	No. OF CONTAINERS	PLAST PRESE USED	INER TYPE IC (P) or C RVATIVE	LASS (G			7	7	<del>/</del> /				FIELD DOCOMENTATION	1,11,11,11,11,11,11,11,11,11,11,11,11,1
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# **ATTACHMENT B-7**

CHAIN-OF-CU	STODY SEAL
Signature	CUSTODY SEAL
Date	Date
CUSTODY SEAL	Signature

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73-		FIEL	D ANA	LYTICA	L LOG S	SHEET			
		GEO	CHEMI	CAL PA	RAMET	ERS			
Tetra Tech NUS,	Inc.							Page of _	
Project Site !	Name:					Sample ID N	o.:		
Project No.:						Sample Loca	ition:		
Sampled By:				•		Duplicate:			
Field Analyst		<del></del>		. r		Blank:			
Field Form C	hecked as per C	A/QC Che	cklist (init	ials):	ilija stierimien	GALLES SERVICE	Samuel Contraction	odalija i postava	
	一种推动。中国	Color	京 PH	s.c.	Temp.	Turbidity	DO DO	Salinity	Other
Date:		(Visual)	(SU)	(mS/cm)	l _ '	(NTU)	(mg/1)	(%)	""
Method:									
	CTIONANALYSIS					<b>特松斯尼斯尼托</b> 加拉	<b>新闻间期</b>	推出。推進海洋	<b>建,果</b>
ORP (Eh) (+/-	mv):			Make & Mod				<del></del>	
Dissolved Ox		<del></del> _	Reference	Electrode (	circle one):	Silver-Silver Chio	ride / Calomel	/ Hydrogen	
Equipment:	HACH Digital Titrat	or OX-DT	CHEMetric	cs (Ranger ,	mg/l	_)	Analysis Time		
Range Used:	Range	Sample Vol.		Multiplier		Titration Count	Multiplier	Concentration	5
Hange Oseu.	1-5 mg/L	200 ml	0.200 N	0.01	1	And to the count	x 0.01	= mg/L	<b>⊣ I</b>
	2-10 mg/L	100 mi	0 200 N	0.02	j		× 0.02	≃ mg/L	]
CHEMetrics:	mg/L							<del></del>	-
Notes: Alkalinity:							Analysis Time:		
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Range Used:	Range 10-40 mg/L	Sample Vol. 100 ml	0.1600 N	0.1		&	x 0.1	= mg/L	<u>.</u>
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	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 500-2000 mg/L 1000-4000 mg/L	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml	0.1600 N 1.600 N 1.600 N 1.600 N 1 600 N	0.4 1.0 2.0 5.0 10.0	Bio	8 8 8 8	x 0.4 x 1.0 x 2.0 x 5.0	= mg/L = mg/L = mg/L	-
Range Used:  CHEMetrics:  Notes:  Standard Add/ftor	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 500-2000 mg/L 1000-4000 mg/L Parameter: Relationahlp: mg/L	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml	0.1600 N 1.600 N 1.600 N 1.600 N 1 600 N	0.4 1.0 2.0 5.0 10.0	Bic	8 8 8 8	x 0.4 x 1.0 x 2.0 x 5.0	= mg/L = mg/L = mg/L	-
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Range Used:  CHEMetrics: Notes: Standard Additor Carbon Diox	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 500-2000 mg/L 1000-4000 mg/L Perameter: Relationship:mg/L ns:Titran ide: HACH Digital Titra	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetric	0.4 1.0 2.0 5.0 10.0 Digits Req cs (Range:	mg/	&	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd:	mg/L mg/L mg/L mg/L Concentration	
CHEMetrics:	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 1000-4000 mg/L 1000-4000 mg/L Thrande: HACH Digital Titral Range 10-50 mg/L	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide  It Molarity tor CA-DT Sample Vol. 200 ml	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetre Cartndge 0.3636 N	0.4 1.0 2.0 5.0 10.0 Digits Req Cs (Range: Multiplier 0.1	mg/	& & & & & &	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd.:  Analysis Time	mg/L mg/L mg/L mg/L  Concentration mg/L	
CHEMetrics:	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 1000-4000 mg/L 1000-4000 mg/L 1000-4000 mg/L Relationship:	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide  It Molarity: tor CA-DT Sample Vol. 200 ml	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetric Cartndge 0.3636 N 0.3638 N	0.4 1.0 2.0 5.0 10.0 Digits Req Cs (Range: Multiplier 0.1 0.2	mg/	& & & & & &	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd:	mg/L mg/L mg/L mg/L mg/L  Concentration mg/L	
CHEMetrics:	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 1000-4000 mg/L 1000-4000 mg/L Thrande: HACH Digital Titral Range 10-50 mg/L	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide  It Molarity tor CA-DT Sample Vol. 200 ml	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetre Cartndge 0.3636 N	0.4 1.0 2.0 5.0 10.0 Digits Req Cs (Range: Multiplier 0.1 0.2	mg/	& & & & & &	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd: Analysis Time x 0.1 x 0.2	= mg/L	
CHEMetrics:	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 1000-4000 mg/L 1000-4000 mg/L 1000-4000 mg/L Relationship:	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide  Hydroxide  Sample Vol. 200 ml 100 ml	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetric Cartndge 0.3636 N 0.3636 N	0.4 1.0 2.0 5.0 10.0  Digits Req  Cs (Range:  Multiplier 0.1 0.2 1.0	mg/	& & & & & &	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd.: Analysis Time x 0.1 x 0.2 x 1.0	= mg/L	
CHEMetrics: Notes: Standard Addrivor Carbon Diox Equipment: Range Used:	10-40 mg/L 40-160 mg/L 100-400 mg/L 200-800 mg/L 1000-4000 mg/L 1000-4000 mg/L 1000-4000 mg/L Relationship:	100 ml 25 ml 100 ml 50 ml 20 ml 10 ml 10 ml Hydroxide  Hydroxide  Sample Vol. 200 ml 100 ml	0.1600 N 1.600 N 1.600 N 1.600 N Carb CHEMetric Cartndge 0.3636 N 0.3636 N	0.4 1.0 2.0 5.0 10.0  Digits Req  Cs (Range:  Multiplier 0.1 0.2 1.0 2.0	mg/	& & & & & &	x 0.4 x 1.0 x 2.0 x 5.0 x 10.0 3rd.: Analysis Time x 0.1 x 0.2 x 1.0	= mg/L	

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	ATTAC	HMENT B-8 (Cor	ntinued)		
TŁ		ALYTICAL LOG MCAL PARAME		Page of _	
Tetra Tech NUS, Inc.	<del></del>			rageoi_	
Project Site Name:		_	Sample ID No.	•	_
Project No.:		_	Sample Location	on:	_
Sampled By:		<u> </u>	Duplicate:		1
Field Analyst:			_Blank: [		
Field Form Checked as pe SAMPLE COLLECTION ANALYS			61 (\$2 (\$1) (\$1) (\$1) (\$1) (\$1) (\$1) (\$1)	1410 1015 1115 1115 1115 1115 1115 1115	Upday 1866
Sulfide (S <sup>2</sup> ):	<b>NONTROPHEND TO SERVICE SERV</b>	(27) 通常和 編表財政性 [0.五百] [韓古聖	·	出一点的 1983 AM ALL MATERIAL TO A 1985 和 1985 和 1985 AM A	T0.9Th 1.72
Equipment: DR-700	DR-8 HS-WR	Color Wheel Otho	<del>-</del>	Analysis Time:	1
Program/Module: 610nm	93	- CO. T. T. T. CO.	·		.
. regioniemeest o tomi					
Concentration:	mg/L			Filtered:	
Notes:					.
Sulfate (S0 <sub>4</sub> 27):					
Equipment: DR-700	DR-8 Other	:	_	Analysis Time:	.
Program/Module:	91				
Concentration:	mg/L			Filtered:	1
Standard Solution:	Results				Ì
Standard Additions:	Digits Required: 0 1m	 l: 0.2ml·	0.3ml·		
Notes:	•				
Nitrite (NO <sub>2</sub> -N):				Analysis Time:	. ]
Equipment: DR-700	DR-8 Other	:	_	Filtered:	1
Program/Module:	60			<del></del>	
Concentration.	mg/L		-	ank Correction:	
			Standard Solution:	Results:	-
Notes:					-
Nitrate (NO <sub>3</sub> -N):	······································			Analysis Time:	
Equipment: DR-700	DR-8 Othe	r		Filtered:	-
Program/Module:	55		_		- }
Concentration:	mg/L				Į
			Nitrite Interfere	ence Treatment:	
Standard Solution:	Results:			lank Correction.	
Standard Additions:		 nl: 0.2ml:	_		- 1
	<u>-</u> • • • • • • • • • • • • • • • • • • •				
Notes:					_ 1

ATTACHMENT B-8 (Continued)	t	Number SA-6.3	Page 19 of 37
ATTACHMENT B-8 (Continued)    FIELD ANALYTICAL LOG SHEET GEOCHEMICAL PARAMETERS	FIELD DOCUMENTATION		
FIELD ANALYTICAL LOG SHEET GEOCHEMICAL PARAMETERS  Page of			
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GEOCHEMICAL PARAMETERS  Page of	ATTA	ACHMENT B-8 (Continue	ed)
Terra Tech NUS, Inc.    Page of	FIELD /	ANALYTICAL LOG SHE	ET
Project Site Name: Sample ID No.: Project No: Sample Location: Duplicate:   Sample By: Duplicate:   Field Analyst: Blank:   Field Form Checked as per QA/OC Checklist (initials):   Sample CouteCritoNaNaNa/Sist INFORMATION 18: SAMPLE-COUTECTION 2008 AND 2008	GEOCH	IEMICAL PARAMETERS	
Project No.:   Sample Location:   Duplicate:   Duplicate:   Blank:	Tetra Tech NUS, Inc.		Page of
Project No.:   Sample Location:   Duplicate:   Duplicate:   Blank:	Project Site Name:	Sam	nple ID No.:
Sampled By:   Field Analyst:   Blank:			· · · · · · · · · · · · · · · · · · ·
Field Analyst:   Blank:			
Field Form Checked as per QA/OC Checklist (initials):		<del></del>	
Manganese (Mn²²):   Equipment: DR-700	Field Form Checked as per QA/QC Checklis	et (initials):	_
Equipment: DR-700 DR-8	SAMPLE COLLECTION ANALYSIS INFORMATION 10	,作品的資子就會了的,但因此時間的學術,可能可以	<b>到流面型机力试验到流光性的特殊的现在外,更多更多的。</b>
Program/Module: 525nm 41  Concentration:	Manganese (Mn²+):		
Concentration:mg/L	Equipment: DR-700 DR-8 HAC	CH MN-5 Other:	Analysis Time:
Digestion:	Program/Module: 525nm 41	•	_ !
Standard Solution:   Results:   Reagent Blank Correction:	Concentration:mg/L		Filtered:
Standard Additions: Digits Required: 0.1ml: 0.2ml: 0.3ml: Notes:    Digits Required: 0.1ml: 0.2ml: 0.3ml:			Digestion:
Notes:			<u> </u>
Ferrous Iron (Fe <sup>2+</sup> ):  Equipment: DR-700 DR-8 _ IR-18C Color Wheel Other:	Standard Additions: LJ Digits Required: 0.	.1ml: 0.2ml: 0.3r	ni:
Equipment: DR-700 DR-8	Notes:		
Equipment: DR-700 DR-8			
Program/Module: 500nm 33  Concentration:mg/L			[ ]
Concentration:mg/L		8C Color Wheel Other:	Analysis Time:
Notes:  Hydrogen Sulfide (H <sub>2</sub> S):  Equipment: HS-C Other:			[]
Hydrogen Sulfide (H <sub>2</sub> S):  Equipment: HS-C Other:			Filtered:
Equipment: HS-C Other: Analysis Time:  Concentration: mg/L Exceeded 5.0 mg/L range on color chart:  Notes:   GA/QC Checkfist:  All data fields have been completed as necessary:  Correct measurement units are cited in the SAMPLING DATA block:  Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:  Multiplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test il Nitrite was detected:	Notes:		
Equipment: HS-C Other: Analysis Time:  Concentration: mg/L Exceeded 5.0 mg/L range on color chart:  Notes:   GA/QC Checkfist:  All data fields have been completed as necessary:  Correct measurement units are cited in the SAMPLING DATA block:  Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:  Multiplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test il Nitrite was detected:	Hydrogen Sulfide (H-S):		
Concentration:mg/L Exceeded 5.0 mg/L range on color chart:			Analysis Time
All data fields have been completed as necessary:  Correct measurement units are cited in the SAMPLING DATA block:  Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:  Mulitplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:		<del></del>	Allaysis films.
All data fields have been completed as necessary:  Correct measurement units are cited in the SAMPLING DATA block:  Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:  Mulitplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:	Concentration: mo/l. Fxc	eeded 5.0 mg/L range on color chart:	. n
QA/QC Checklist:  All data fields have been completed as necessary:  Correct measurement units are cited in the SAMPLING DATA block:  Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:  Mulitplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:	Notes:		
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Mulitplication is correct for each Multiplier table:  Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:	Correct measurement units are cited in the SAMP	LING DATA block:	
Final calulated concentration is within the appropriate Range Used block:  Alkalinity Relationship is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:	Values cited in the SAMPLING DATA block are co	nsistent with the Groundwater So	ample Log Sheet:
Alkalinity <i>Relationship</i> is determined appropriatly as per manufacturer (HACH) instructions:  QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:  Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:	Mulitplication is correct for each Multiplier table.		
QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:    Comparison	, canada ser secon munipuor table.	ate Range Used block:	]
Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:			
Nitrite Interference treatment was used for Nitrate test if Nitrite was detected:	Final calulated concentration is within the appropri	as per manufacturer (HACH) inst	iructions: []
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Title block on each page of form is initialized by person who performed this QA/QC Checklist:	Final calulated concentration is within the appropri Alkalinity <i>Relationship</i> is determined appropriatly of QA/QC sample (e.g., Std. Additions, etc.) frequence	cy is appropriate as per the proje	

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# ATTACHMENT C-1 EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

<b>T</b>	tra Tech NUS,	Inc	GROUNDW	ATER LE	EVEL MEAS	UREMEN	T SHEET	
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ocation:		• ·		······································	Personnel:			
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idally Infl		Vac	No		Remarks:	AICe:		
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Winasa (			Risostica of	Total	Water Level Indicator Reading (foot)*	Thickness	G-nh-Allera	
resometer .	Data	Time	Reference Point	Well Depth	Indicator Reading	Pres Product	Elevation	Comments
Number		08138888 000027	(feet)*	(feet);	(fuet)*	(feet)*	(foat)*	
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# ATTACHMENT C-2 EXAMPLE PUMPING TEST DATA SHEET

	NAME: NUMBER:			PUMPING WELL NUMBER MEASURED WELL NUMBER:								
	NOMBER. IPING TES											
				[ ] STEP DRAW DOWN TEST								
DATE(s).	ENT METHOD	· · ·		MONITORING POINT: DEPTH CORRECTION (ft).								
TEST NUMBI			-	PUMP SETTING (Ft_below monitoring point):								
STATIC WAT	ER LEVEL (ft	):		DISTANCE	FROM PUMPI	NG WELL (ft):						
PERSONNEL	÷						<del></del>					
REMARKS												
11 (E)	lar da					<u> </u>	-,11 - ,					
MILITARY ITIME	ELAPSED TIME SINCE PUMP START OR STOP (MIL)	WATER LEVEL	CORRECTION (FL)	DRAW DOWN OR RECOVERY (Ft)	PUMPING RATE (GPM)	FLOW METER READING (Gals)	REMARKS					
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NOTE: All measurements to nearest 0 01 foot measured from top of well riser pipe unless otherwise noted

														ח		Subject
T	F					PA		ACHMEI	NT C-3 PORT F	ORM			<u>.</u>		FIELD DO	
PROJECT: BORING P TEST INTI	10.:		_ CASI	NG DEPTH BY:	l:	PROJ	CONT	RACTOR: HECKED:			ST NO:	STA	PAGE OF THE WATER LEVEL  KER PRESSURE  TEST COMPRESIDENT OF		FIELD DOCUMENTATION	: :
Pretiute a	Eleptord Limits (mws)	Flow Test Flow Reading	A Flow, AQ (ft)	å Flow, åQ (get)	Flow Rate Q (gal/min)	H(a	) 31-(brt) Hülefi -	(4) H.	M - Hb v (H1 or H2)	Ç	K(tuys) = Cp-QM	K (cm/sec) = 9 67 x 10-1 K (ftoye)	(1 opt)		ATION	!
														ATTACHMENT C-3	Revision 1	Number SA-6.
													Packer	NT C-3		1-6.3
													footh   Cp			
CP = (1/(2 =) 7 48 Gatlons 1 ps: = 2 31 Remarks	(l head	0,315 5)		* H <sub>3</sub> is use	ed when th	ie test lengt	th is below the	water table	E L				1 31.000 35.501 27.300 21.000 2 1.000		Effective Date 01/00	Page 22 of 37
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		NAM	E:						BOI	RING N	lo.: _					
DRIL	LING		BEH: PANY:						GE	DLOGI:						
DRIL	LING	RIG	r			LATEC	21.01	DECO		LLER:	- <u>-</u>			===	_	
Semple No. end Type of RQD	Dapth (PL) or Run No.	Blows / 5" or RGD (%)	Sample Recovery / Sample Length	Uthology Change (Depth/PL) or Screened Interval	Boll Claretty Consistericy Prock Hearthean	Color	2.5 2.5 2.6 2.6 2.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3	Material (	IPTION	on 3 (2)	U 8 C 8 •	Remarks	PID/F	ş 5	××.	<b>%</b> .
					\$ 68 (S)	* ;	3.88° *****	<u> </u>	: 20 80 3 787 80	199,443			* {	<b>3</b> ₹ \$	₹% ₹35	が 後
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SOU TERMS UNIFIED SOIL CLASSIFICATION (USCS)										
COARSE-GRAINED SOILS FINE-GRAINED SOILS										
	Life	re Than Half of Material is LARGER Than	No 200 S	leve Size		1	More Than Half of M	aterial is SMALLER Tha	n No 200	) Sieve Size
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights			GROU P SYMB OL	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)					TYPICAL NAMES
			1		Identific	ation Procedures on Fracti	on Smaller than No	40 Sieve Size		
						DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
GRAVELS (50%(+)>1/4"s	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		Welf graded gravels, gravel-sand modures, little or no fines.	SILTS AND CLAYS Liquid Limit <50	None to Slight	Quick to Slow	None	ML	Inorganic sitts and very fine sands, rock flour, sitty clayey fine sands with slight plasticity
		Predominantly one size or a range of sizes with some intermediate sizes missing		Poorly graded gravels, gravel-sand mixtures, little or no lines.		Medium to High	None to Very Slow	Medium	α	Inorganic clays of low to medium plasticity, grave clays, sandy clays, sitty clays, lean clays.
	GRAVELS W/FINES (High % Fines)	Non-plastic tines (for identification procedures, see ML)	GM	Sity gravels, poorly graded gravel-sand-sit mixtures		Slight to Medium	Slow	Slight	ÖL	Organic sits and organic sit-days of low plasticity
		Plantic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand- clay mixtures.	SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	МН	tronganic sills, micaceous or diatomaceous is sandy or silly soils, startic silts
SANDS 50%(+)<1/4"o	(Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		Well graded sand, gravely sands, little or no lines.		High to Very High	None	High	СН	Inorganio clays of high plasticity, fat clays.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	æ	Poorty graded sands, gravely sands, little or no lines.		Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity
		Non-plastic lines (for identification procedures, see MCL)		Sity sands, poorly graded sand-sit mixtures.	HIGHLY ORGANIC SOILS	ORGANIC fibrous lexture.			Pt	Pest and other organic solls
	!	Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay multipres.						

All sleve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS									
DESIGNATION	STANDARD PENETRATION RESISTANCE- BLOWS/FOOT								
Vary Loose	0-4								
Loose	5-10								
Medium Loose	11-30								
Dense	31-50								
Very Dense	Over 50								

CONSISTENCY OF COHESIVE SOILS							
CONSISTENCY	UNC COMPRESSIVE STRENGTH (TONS/SQ FT.)	STANDARD PENETRATION RESISTANCE- BLOWSFOOT	FIELD IDENTIFICATION METHODS				
Very Soft	Less than 0.25	0 to 2	Easily pentrated soveral inches by fist				
Soft	0.25 to 0 50	2 to 4	Easily penetrated several inches by thursts.				
Medium Stiff	0.50 to 10	4 to 8	Can be penetrated several inches by thumb.				
SUN	1.0 to 2.0	8 to 15	Readily indenied by thumb.				
Very Stiff	20 to 40	15 to 30	Readly Indenied by thumbrial.				
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnall.				

ROCK TERMS

		NOON IENMO				
	ROCK HARDNESS (FRO	ROCK BROKENESS				
Descriptive Terms	Screwdriver or Knille Effects	Hammer Effects	Descriptive Terms	Abbreviation	Specing	
Soft	Easily Gouged	Crushes when pressed with hammer	Very Broken	(V Br.)	0.2*	
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges	Broken	(Br)	2"-1"	
Medium Hard	Can be scratched	Breaks (one blow), sharp edges	Blocky	(BL)	1:-3"	
Hard	Cannot be scratched	Breaks concholdally (several blows); sharp edges	Matelys	(M)	3-10	

LEGEND.

SOIL SAMPLES - TYPES

ROCK SAMPLES - TYPES

WATER LEVELS

5-2" Spft-Barrel Sample

X-NX (Conventional) Core (-2 1/8" O.D.)

12/18
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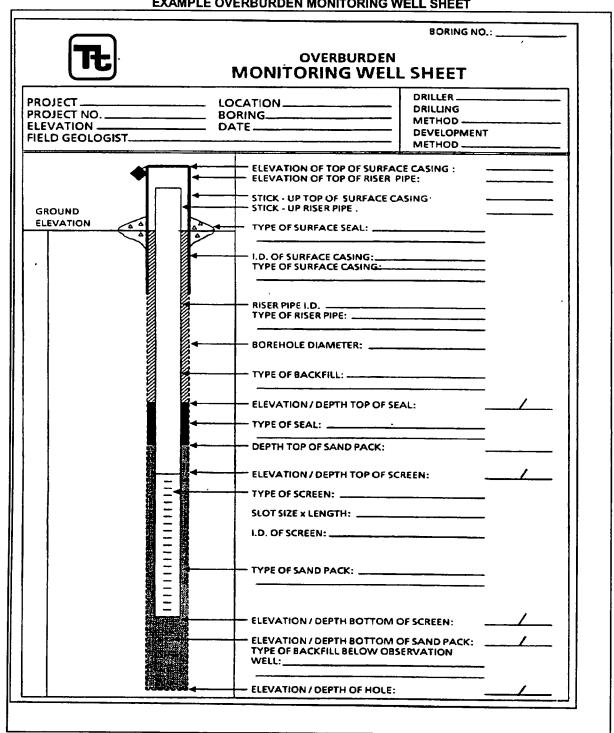
ST-3" O.D. Undisturbed Sample O - Other Samples, Specify in Remarks

Q-NQ (Wireline) Core (- 1-7/8\* O D ) Z - Other Core Sizes, Specify in Remarks

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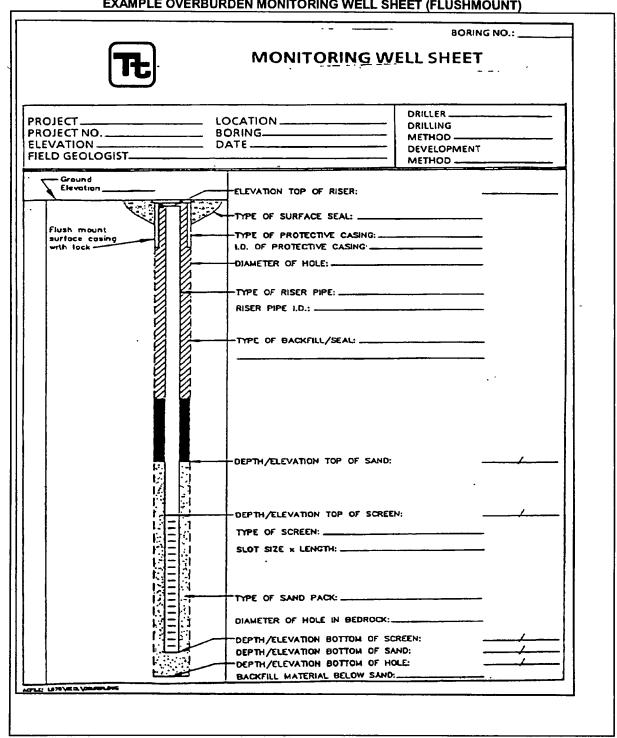
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# ATTACHMENT C-5 EXAMPLE OVERBURDEN MONITORING WELL SHEET



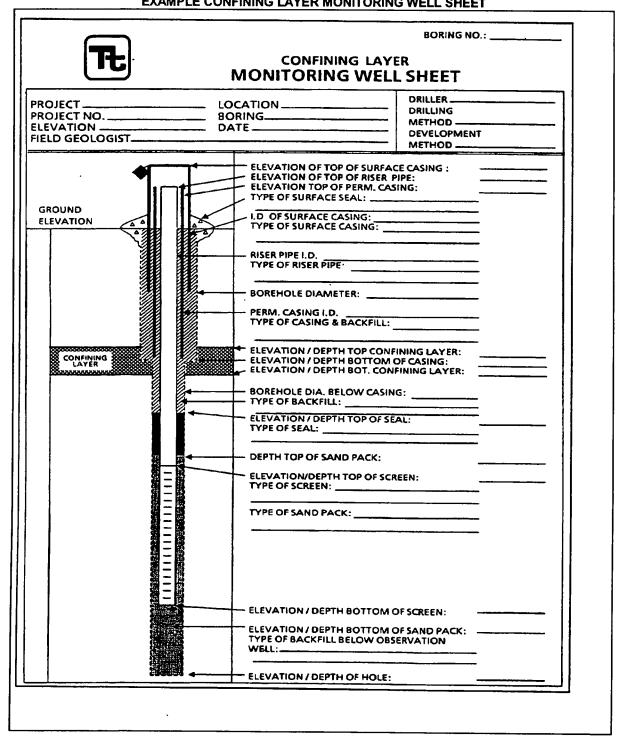
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# ATTACHMENT C-5A EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)



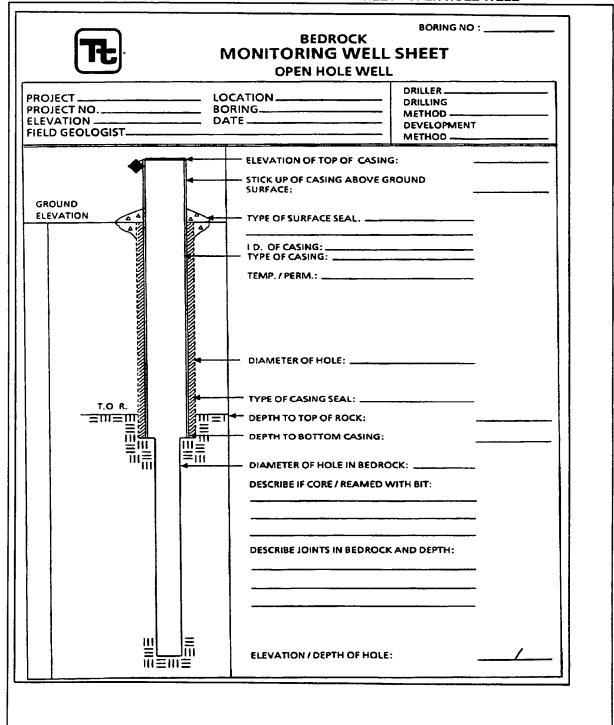
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# ATTACHMENT C-6 EXAMPLE CONFINING LAYER MONITORING WELL SHEET



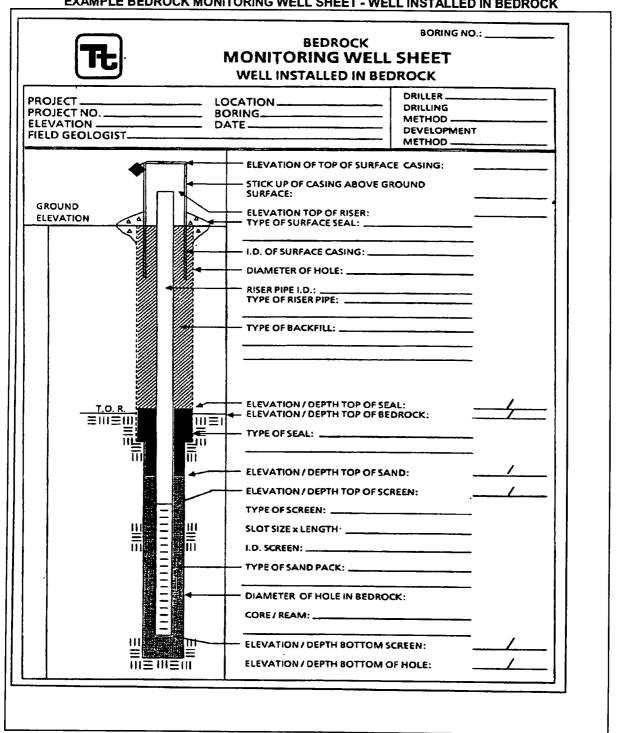
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# ATTACHMENT C-7 EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL



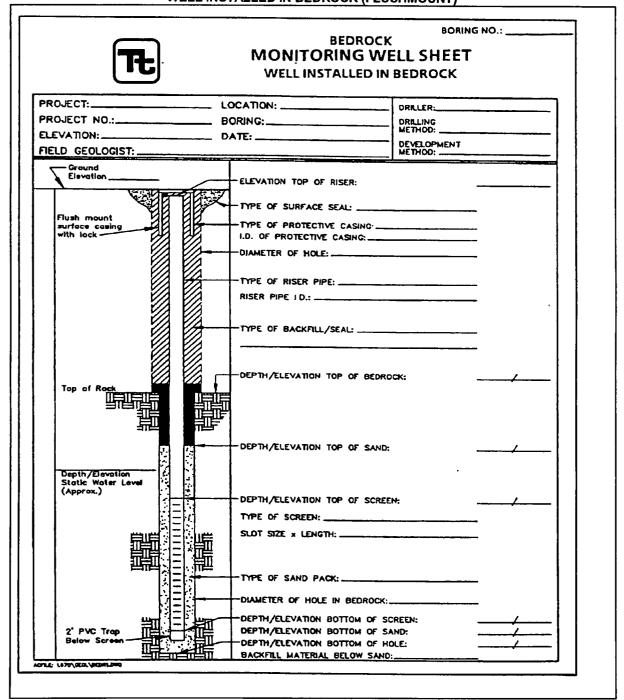
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## ATTACHMENT C-8 EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK



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## ATTACHMENT C-9 EXAMPLE BEDROCK MONITORING WELL SHEET WELL INSTALLED IN BEDROCK (FLUSHMOUNT)



CHMENT C-10 E TEST PIT LC	Tetra Tech TEST PIT NO.:	
E TEST PIT LO	Tetra Tech TEST PIT NO.:	KS .
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REMARKS

PHOTO LOG

TEST PIT

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#### MONITORING WELL MATERIALS CERTIFICATE OF CONFORMANCE

Weii Designation:	Site Geologist:
Sile Name:	Drilling Company:
Date Installed:	Driller:
Project Name:	Project Number.

#### Material Brand/Description Source/Supplier Samole Collected ? Well Casing Well Screen End Cap **Drilling Fluid** Drilling Fluid Additives Backfill Material Amnular Filter Pack **Bentonite Seal Annular Grout** Surface Cement **Protective Casing** Paint Rod Lubricant Compressor Off

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologis	1:1
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# ATTACHMENT C-11 EXAMPLE CERTIFICATE OF CONFORMANCE

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Subject

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Dev. Meth	od		Depth to Bottom (" Static Water Leve Static Water Leve Screen Length (it. Specific Capacity: Casing ID (in.):	Ķ		_Draing Co.^			; ; ;	EXAMPI	FIELD DOCUMENTATION	
Tanto	Estimated Sederient Thickness (Ft.)	Cumutative Water Volume (Gall)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	рH	Specific Conductance (Units)	Turbidity (NTU)	Remarks (odor, cotor, etc.)		E MONITO		
										ATTACHMENT C-12 EXAMPLE MONITORING WELL DEVELOPMENT RECORD	Revision 1	Number SA-6.3
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PROJECT NAME:   INSTRUMENT NAME/MODEL:   SITE NAME:   MANUFACTURER:   SERIAL NUMBER:   SERIAL NUMBER:   Date   Instrument   Person   Instrument Settlings   Instrument Readings   Calibration   I.D.   Calibration   Calibration	Subject FIE			.og	BRATION I	ENT CALIE	EQUIPME		US, Inc.	Tetra Tech N	Æ
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PROJECT NAME:	AME: PROJECT NUMBER:								
CLIENT:			PROJECT NUMBER LOCATION:						
DATE:			ARRIVAL TIME:	-					
Tt NUS PERSONNEL:		DEPARTURE TIME:							
CONTRACTOR:			DRILLER:						
ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE					
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t NUS REPRESENTATIVE		- I	DRILLER						
		_	DRILLER DATE:						

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		Personnel:
Weather:		Onsite:
Site Activities:		
MONDAY		
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Site Activities:		

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## STANDARD OPERATING PROCEDURES

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Applicability	

TETRA TECH NUS, INC.

Subject DECONTAMINATION OF FIELD EQUIPMENT

AND WASTE HANDLING

Applicability
Tetra Tech NUS, Inc.

Prepared

Earth Sciences Department

Approved

D. Senovich

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#### 1.0 PURPOSE

The purpose of this procedure is to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

#### 2.0 SCOPE

This procedure addresses drilling equipment and monitoring well materials decontamination, as well as chemical sampling and field analytical equipment decontamination. This procedure also provides general reference information on the control of contaminated materials.

#### 3.0 GLOSSARY

<u>Acid</u> - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

<u>Deionized Water</u> - Deionized (analyte free) water is tap water that has been treated by passing through a standard deionizing resin column. Deionized water should contain no detectable heavy metals or other inorganic compounds at or above the analytical detection limits for the project.

<u>Potable Water</u> - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

#### 4.0 RESPONSIBILITIES

<u>Project Manager</u> - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

<u>Field Operations Leader (FOL)</u> - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

#### 5.0 PROCEDURES

To ensure that analytical chemical results reflect actual contaminant concentrations present at sampling locations, the various drilling equipment and chemical sampling and analytical equipment used to acquire the environment sample must be properly decontaminated. Decontamination minimizes the potential for cross-contamination between sampling locations, and the transfer of contamination off site.

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#### 5.1 **Drilling Equipment**

Prior to the initiation of a drilling program, all drilling equipment involved in field sampling activities shall be decontaminated by steam cleaning at a predetermined area. The steam cleaning procedure shall be performed using a high-pressure spray of heated potable water producing a pressurized stream of steam. This steam shall be sprayed directly onto all surfaces of the various equipment which might contact environmental samples. The decontamination procedure shall be performed until all equipment is free of all visible potential contamination (dirt, grease, oil, noticeable odors, etc.) In addition, this decontamination procedure shall be performed at the completion of each sampling and/or drilling location, including soil borings, installation of monitoring wells, test pits, etc. Such equipment shall include drilling rigs, backhoes, downhole tools, augers, well casings, and screens. Where the drilling rig is set to perform multiple borings at a single area of concern, the steam-cleaning of the drilling rig itself may be waived with proper approval. Downhole equipment, however, must always be steam-cleaned between borings. Where PVC well casings are to be installed, decontamination is not required if the manufacturer provides these casings in factory-sealed, protective, plastic sleeves (so long as the protective packaging is not compromised until immediately before use).

The steam cleaning area shall be designed to contain decontamination wastes and waste waters and can be a lined excavated pit or a bermed concrete or asphalt pad. For the latter, a floor drain must be provided which is connected to a holding facility. A shallow above-ground tank may be used or a pumping system with discharge to a waste tank may be installed.

In certain cases such an elaborate decontamination pad is not possible. In such cases, a plastic lined gravel bed pad with a collection system may serve as an adequate decontamination area. Alternately, a lined sloped pad with a collection pump installed at the lower end may be permissible. The location of the steam cleaning area shall be onsite in order to minimize potential impacts at certain sites.

Guidance to be used when decontaminating drilling equipment shall include:

- As a general rule, any part of the drilling rig which extends over the borehole, shall be steam cleaned.
- All drilling rods, augers, and any other equipment which will be introduced to the hole shall be steam cleaned.
- The drilling rig, all rods and augers, and any other potentially contaminated equipment shall be decontaminated between each well location to prevent cross contamination of potential hazardous substances.

Prior to leaving at the end of each work day and/or at the completion of the drilling program, drilling rigs and transport vehicles used onsite for personnel or equipment transfer shall be steam cleaned, as practicable. A drilling rig left at the drilling location does not need to be steam cleaned until it is finished drilling at that location.

Error! Bookmark not defined.5.2 Sampling Equipment

#### 5.2.1 Bailers and Bailing Line

The potential for cross-contamination between sampling points through the use of a common bailer or its attached line is high unless strict procedures for decontamination are followed. For this reason, it is preferable to dedicate an individual bailer and its line to each sample point, although this does not eliminate the need for decontamination of dedicated bailers. For non-dedicated sampling equipment, the following conditions and/or decontamination procedures must be followed.

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Before the initial sampling and after each successive sampling point, the bailer must be decontaminated. The following steps are to be performed when sampling for organic contaminants. Note: contract-specific requirements may permit alternative procedures.

- Potable water rinse
- Alconox or Liquinox detergent wash
- Scrubbing of the line and bailer with a scrub brush (may be required if the sample point is heavily contaminated with heavy or extremely viscous compounds)
- Potable water rinse
- Rinse with 10 percent nitric acid solution\*
- Deionized water rinse
- Pesticide-grade isopropanol (unless otherwise required)
- Pesticide-grade hexane rinse\*\*
- Copious distilled/Deionized water rinse
- Air dry

If sampling for volatile organic compounds (VOCs) only, the nitric acid, isopropanol, and hexane rinses may be omitted. Only reagent grade or purer solvents are to be used for decontamination. When solvents are used, the bailer must be thoroughly dry before using to acquire the next sample.

In general, specially purchased pre-cleaned disposable sampling equipment is not decontaminated (nor is an equipment rinsate blank collected) so long as the supplier has provided certification of cleanliness. If decontamination is performed on several bailers at once (i.e., in batches), bailers not immediately used may be completely wrapped in aluminum foil (shiny-side toward equipment) and stored for future use. When batch decontamination is performed, one equipment rinsate is generally collected from one of the bailers belonging to the batch before it is used for sampling.

It is recommended that clean, dedicated braided nylon or polypropylene line be employed with each bailer use.

#### 5.2.2 Sampling Pumps

Most sampling pumps are low volume (less than 2 gpm) pumps. These include peristaltic, diaphragm, airlift, pitcher and bladder pumps, to name a few. If these pumps are used for sampling from more than one sampling point, they must be decontaminated prior to initial use and after each use.

The procedures to be used for decontamination of sampling pumps compare to those used for a bailer except that the 10 percent nitric acid solution is omitted. Each of the liquid factions is to be pumped through the system. The amount of pumping is dependent upon the size of the pump and the length of the intake and discharge hoses. Certain types of pumps are unacceptable for sampling purposes. For peristaltic pumps, the tubing is replaced rather than cleaned.

An additional problem is introduced when the pump relies on absorption of water via an inlet or outlet hose. For organic sampling, this hose should be Teflon. Other types of hoses leach organics (especially phthalate esters) into the water being sampled or adsorb organics from the sampled water. For all other sampling, the hose should be Viton, polyethylene, or polyvinyl chloride (listed in order of preference).

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<sup>\*</sup> Due to the leaching ability of nitric acid on stainless steel, this step is to be omitted if a stainless steel sampling device is being used and metals analysis is required with detection limits less than approximately 50 ppb.

<sup>\*\*</sup> If sampling for pesticides, PCBs, or fuels.

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Whenever possible, dedicated hoses should be used. It is preferable that these types of pumps not be used for sampling, only for purging.

#### 5.2.3 Filtering Equipment

On occasion, the sampling plan may require acquisition of filtered groundwater samples. Field-filtering is addressed in SOP SA-6.1 and should be conducted as soon after sample acquisition as possible. To this end, three basic filtration systems are most commonly used: the in-line disposable Teflon filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

For the in-line filter, decontamination is not required since the filter cartridge is disposable, however, the cartridge must be disposed of in an approved receptacle and the intake and discharge lines must still be decontaminated or replaced before each use.

For the over-pressure and the vacuum filtration systems, the portions of the apparatus which come in contact with the sample must be decontaminated as outlined in the paragraphs describing the decontamination of bailers. (Note: Varieties of both of these systems come equipped from the manufacturer with Teflon-lined surfaces for those that would come into contact with the sample. These filtration systems are preferred when decontamination procedures must be employed.)

#### 5.2.4 Other Sampling Equipment

Field tools such as trowels and mixing bowls are to be decontaminated in the same manner as described above.

#### 5.3 <u>Field Analytical Equipment</u>

#### 5.3.1 Water Level Indicators

Water level indicators that come into contact with groundwater must be decontaminated using the following steps:

- Rinse with potable water
- · Rinse with deionized water

Water level indicators that do not come in contact with the groundwater but may encounter incidental contact during installation or retrieval need only undergo the first and last steps stated above.

#### 5.3.2 Probes

Probes (e.g., pH or specific-ion electrodes, geophysical probes, or thermometers) which would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise (e.g., dissolved oxygen probes). Probes that contact a volume of groundwater not used for laboratory analyses can be rinsed with deionized water. For probes which make no direct contact, (e.g., OVA equipment) the probe is self-cleaning when exposure to uncontaminated air is allowed and the housing can be wiped clean with paper-towels or cloth wetted with alcohol.

#### 5.4 Waste Handling

For the purposes of these procedures, contaminated materials are defined as any byproducts of field activities that are suspected or known to be contaminated with hazardous substances. These byproducts

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include such materials as decontamination solutions, disposable equipment, drilling muds, well-development fluids, and spill-contaminated materials and Personal Protection Equipment (PPE).

The procedures for obtaining permits for investigations of sites containing hazardous substances are not clearly defined at present. In the absence of a clear directive to the contrary by the EPA and the states, it must be assumed that hazardous wastes generated during field activities will require compliance with Federal agency requirements for generation, storage, transportation, or disposal. In addition, there may be state regulations that govern the disposal action. This procedure exclusively describes the technical methods used to control contaminated materials.

The plan documents for site activities must include a description of control procedures for contaminated materials. This planning strategy must assess the type of contamination, estimate the amounts that would be produced, describe containment equipment and procedures, and delineate storage or disposal methods. As a general policy, it is wise to select investigation methods that minimize the generation of contaminated spoils. Handling and disposing of potentially hazardous materials can be dangerous and expensive. Until sample analysis is complete, it is assumed that all produced materials are suspected of contamination from hazardous chemicals and require containment.

#### 5.5 <u>Sources of Contaminated Materials and Containment Methods</u>

#### 5.5.1 Decontamination Solutions

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. Larger equipment such as backhoes and tractors must be decontaminated in an area provided with an impermeable liner and a liquid collection system. A decontamination area for large equipment could consist of a bermed concrete pad with a floor drain leading to a buried holding tank.

#### 5.5.2 Disposable Equipment

Disposable equipment that could become contaminated during use typically includes PPE, rubber gloves, boots, broken sample containers, and cleaning-wipes. These items are small and can easily be contained in 55-gallon drums with lids. These containers should be closed at the end of each work day and upon project completion to provide secure containment until disposed.

#### 5.5.3 Drilling Muds and Well-Development Fluids

Drilling muds and well-development fluids are materials that may be used in groundwater monitoring well installations. Their proper use could result in the surface accumulation of contaminated liquids and muds that require containment. The volumes of drilling muds and well-development fluids used depend on well diameter and depth, groundwater characteristics, and geologic formations. There are no simple mathematical formulas available for accurately predicting these volumes. It is best to rely on the experience of reputable well drillers familiar with local conditions and the well installation techniques selected. These individuals should be able to estimate the sizes (or number) of containment structures required. Since guesswork is involved, it is recommended that an slight excess of the estimated amount of containers required will be available.

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Drilling muds are mixed and stored in what is commonly referred to as a mud pit. This mud pit consists of a suction section from which drilling mud is withdrawn and pumped through hoses, down the drill pipe to the bit, and back up the hole to the settling section of the mud pit. In the settling section, the mud's velocity is reduced by a screen and several flow-restriction devices, thereby allowing the well cuttings to settle out of the mud/fluid.

The mud pit may be either portable above-ground tanks commonly made of steel (which is preferred) or stationary in-ground pits as depicted in Attachment A. The above-ground tanks have a major advantage over the in-ground pits because the above-ground tanks isolate the natural soils from the contaminated fluids within the drilling system. These tanks are also portable and can usually be cleaned easily.

As the well is drilled, the cuttings that accumulate in the settling section must be removed. This is best done by shoveling them into drums or other similar containers. When the drilling is complete, the contents of the above-ground tank are likewise shoveled or pumped into drums, and the tank is cleaned and made available for its next use.

If in-ground pits are used, they should not extend into the natural water table. They should also be lined with a bentonite-cement mixture followed by a layer of flexible impermeable material such as plastic sheeting. Of course, to maintain its impermeable seal, the lining material used would have to be nonreactive with the wastes. An advantage of the in-ground pits is that well cuttings do not necessarily have to be removed periodically during drilling because the pit can be made deep enough to contain them. Depending on site conditions, the in-ground pit may have to be totally excavated and refilled with uncontaminated natural soils when the drilling operation is complete.

When the above-ground tank or the in-ground pit is used, a reserve tank or pit should be located at the site as a backup system for leaks, spills, and overflows. In either case, surface drainage should be such that any excess fluid could be controlled within the immediate area of the drill site.

The containment procedure for well-development fluids is similar to that for drilling muds. The volume and weight of contaminated fluid will be determined by the method used for development. When a new well is pumped or bailed to produce clear water, substantially less volume and weight of fluid result than when backwashing or high-velocity jetting is used.

#### 5.5.4 Spill-Contaminated Materials

A spill is always possible when containers of liquids are opened or moved. Contaminated sorbents and soils resulting from spills must be contained. Small quantities of spill-contaminated materials are usually best contained in drums, while larger quantities can be placed in lined pits or in other impermeable structures. In some cases, onsite containment may not be feasible and immediate transport to an approved disposal site will be required.

#### 5.6 <u>Disposal of Contaminated Materials</u>

Actual disposal techniques for contaminated materials are the same as those for any hazardous substance, that is, incineration, landfilling, treatment, and so on. The problem centers around the assignment of responsibility for disposal. The responsibility must be determined and agreed upon by all involved parties before the field work starts. If the site owner or manager was involved in activities that precipitated the investigation, it seems reasonable to encourage his acceptance of the disposal obligation. In instances where a responsible party cannot be identified, this responsibility may fall on the public agency or private organization investigating the site.

Another consideration in selecting disposal methods for contaminated materials is whether the disposal can be incorporated into subsequent site cleanup activities. For example, if construction of a suitable

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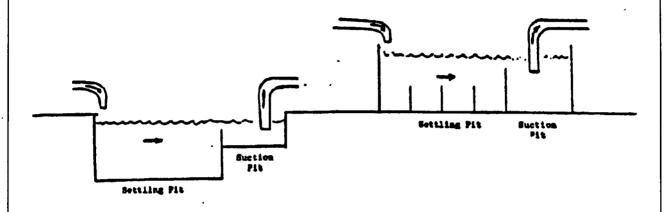
onsite disposal structure is expected, contaminated materials generated during the investigation should be stored at the site for disposal with other site materials. In this case, the initial containment structures should be evaluated for use as long-term storage structures. Also, other site conditions such as drainage control, security, and soil type must be considered so that proper storage is provided. If onsite storage is expected, then the containment structures should be specifically designed for that purpose.

#### 6.0 REFERENCES

<b>Brown &amp; Root Environmental</b>	Standard Operating	g Procedure No. 4.33	, Control of Contaminated Material.
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# ATTACHMENT A TWO TYPES OF MUD PITS USED IN WELL DRILLING



In-Ground Fit

Above-Ground Pit



TETRA TECH NUS, INC.

### STANDARD OPERATING PROCEDURES

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Applicability

Tetra Tech NUS, Inc.

Prepared

Earth Sciences Department

Approved

D. Senovich

Subject

NON-RADIOLOGICAL SAMPLE HANDLING

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#### 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

#### 2.0 SCOPE

#### This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department
  of Transportation (DOT) and International Air Transportation Association (IATA) regulations. IATA
  regulates transportation of hazardous materials by air (which is the mode of transportation used for
  shipping nearly all samples derived during TtNUS projects).

#### 3.0 GLOSSARY

<u>Hazardous Material</u> - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (y261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (y261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

<u>Marking</u> - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

<u>Packaging</u> - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

<u>Placard</u> - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

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#### Common Preservatives:

- Hydrochloric Acid HCl
- Sulfuric Acid H<sub>2</sub>SO<sub>4</sub>
- Nitric Acid HNO<sub>3</sub>
- Sodium Hydroxide NaOH

#### Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

<u>Sample</u> - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

#### 4.0 RESPONSIBILITIES

<u>Field Operations Leader</u> - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

<u>Field Samplers</u> - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

#### 5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

#### 5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused

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containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

#### 5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

#### 5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO<sub>3</sub>, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

#### 5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	<b>Dilution</b>	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCI)	1 part concentrated HCI: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> )	1 part concentrated H₂SO₄: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO <sub>3</sub> )	Undiluted concentrated HNO <sub>3</sub>	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

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- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the
  initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always
  apply a drop of sample to the pH paper using a clean stirring rod or pipette.
- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).
- Cap sample bottle and seal securely.

Additional considerations are discussed below:

To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can
be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for
ascorbic acid addition.

If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

Continue with proper base preservation of the sample as described above.

• Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

The sample pH is then raised to 9 using the NaOH preservative.

 Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory <u>before</u> sampling begins.

#### 5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed <u>prior to</u> the preservation of samples as described above. General procedures for field filtration are described below:

The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after
collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a
peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by
mechanical peristalsis, the sample travels only through the tubing).

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- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter prior to sample collection.
- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

#### 5.4 Sample Packaging and Shipping

Samples collected for shipment from a site shall be classified as either <u>environmental</u> or <u>hazardous</u> <u>material samples</u>. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)
- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

#### 5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.
- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.
- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.
- If cooling is required (see Attachments A and B), double-bag ice in Ziploc baggies and place around sample container shoulders, and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler).
- Seal (i.e., tape or tie top in knot) large liner bag.
- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a
  large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but
  are included on one COC form, the COC form should be sent with the first cooler. The COC form
  should then state how many coolers are included with that shipment.
- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

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Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

#### 5.4.2 Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

NOTE: Packaging and shipping of hazardous materials can only be performed by personnel who have participated in the TtNUS training course "Shipping Hazardous Materials" (or equivalent training approved by Health Sciences).

#### 5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table (49 CFR 172.101) or the IATA List of Dangerous Goods Table (IATA Dangerous Goods Regulations). DOT Guide for shippers can be found in Attachment D of this document.

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

- 1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult Health Sciences or a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .
- 2. Look for the chemical family name. For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .
- 3. Look for a generic name based on end use. For example, Paint, n.o.s. If a generic name based on end use is not listed, then . . .
- 4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .
- 5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

If you have any doubt regarding the proper shipping name, contact Health Sciences in Pittsburgh, Pennsylvania for assistance.

#### 5.4.2.2 <u>Unknown Substances</u>

For samples of hazardous substances that are not listed on the Hazardous Materials Table, or are of unknown content, the shipper is required to:

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- Determine that the substance is not forbidden for shipment. Items forbidden include explosives (solid and liquid), substances liable to produce a dangerous evolution of heat or gas, and listed "unusual" compounds (which TtNUS fortunately does not typically handle). If the substance is in any way atypical of routine shipments, contact Health Sciences for further information on determining if the substance is forbidden.
- Classify the substance by assessing whether it is anticipated to exhibit any unusual physical
  properties as defined by DOT (flammability, explosivity, etc.). If the substance has more than one
  hazard, follow the hazardous materials classification scheme identified in Attachment C of this
  SOP.
- 3. Use the generic or "n.o.s." proper shipping name that most accurately describes the article or substance. There are two types of general proper shipping names:
  - Generic, e.g., Alcohols, n.o.s. \*
  - Hazard description, e.g., Flammable liquid, n.o.s.\*

Generic or n.o.s. proper shipping names marked with an "\*" require the addition of the technical name in parenthesis () immediately following the proper shipping name. For example, most of our instrument calibration gases are not listed by name and must be declared under the most accurately descriptive name, which is "Compressed Gas, n.o.s. (Mixture Nitrogen and Oxygen)".

The correct shipping classification for an unknown sample is therefore selected through a process of elimination as described above (and detailed in 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the DOT and can be found in Attachment D of this SOP. Again, if you have any doubt regarding the proper shipping name, contact Health Sciences for assistance.

#### 5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

#### 5.4.3.1 Packaging

Applying the word "flammable" to a sample does not necessarily mean that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations and classification schemes. The DOT defines flammable liquids as substances with a flash point less than 140°F (60°C). For shipping purposes, liquids with a flash point exceeding 95°F (35°C) need not be considered as flammable liquids if they are miscible solutions and have a water content of more than 90% by weight. For solutions classified as flammable liquids:

- 1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.
- 2. Complete sample label and attach securely to sample container.
- 3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.
- 4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

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5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

#### 5.4.3.2 Marking/Labeling

- 1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):
  - Laboratory name and address.
  - Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101).
     Example: "Flammable Liquid, n.o.s. (with the technical name in parentheses).
- 2. Determine packing group. The packing group must be included on the shipping papers in the description section. Packaging groups are classified as follows:

Group I. Most Hazardous Group II. Medium Hazard Group III. Least Hazardous

The packing group will be listed in the hazardous materials table, column 5.

- 3. Place the following information on outside shipping container per the instructions provided in the "Shipping Hazardous Materials" course:
  - · Proper shipping name
  - UN or NA number
  - Proper label(s)
  - · Addressee and sender

For flammable liquids, the following are the proper labels to be placed on the outside shipping container:

- DOT "Flammable liquid" label
- Package orientation label (arrows pointing upward) on at least two opposite sides of the package
- "Cargo Aircraft Only" label if shipping more than 30L of flammable liquids in the package.

#### 5.4.3.3 Shipping Papers

Principally because of limitations in sample holding times, TtNUS almost exclusively uses air transportation to ship hazardous materials and other environmental samples. The "Dangerous Goods Airbill" is the shipping paper used to document the information associated with the shipment. As identified previously, only personnel who have participated in "Shipping Hazardous Materials" training (or equivalent course) are authorized to prepare hazardous materials for shipment - including preparation of associated shipping papers. Included in this training are instructions on what specific information is to be provided on the Airbill for hazardous materials typically shipped by TtNUS. Refer to the training course Student Manual or contact Health Sciences for this information.

The properly executed Chain-of-Custody Report must be included in the container. Use custody seals.

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Using the Airbill of our common carrier (i.e., Federal Express) as an example, the following instructions apply to the information to be provided under "Transport Details", "Nature and Quantity of Dangerous Goods", and other associated fields.

#### a) Transport Details

- Select "Passenger and Cargo" or "Cargo Aircraft Only" (This is based on the type and quantity of dangerous goods you are shipping). X-out the non-applicable selection.
- Airport of Departure Enter the full name of the airport or city of departure.
- Airport of Destination Enter the full name of the airport or city of destination.
- b) Shipment Type Delete the option that does not apply (Non-Radioactive/Radioactive)
- c) Nature and Quantity of Dangerous Goods
  - 1. Dangerous Goods Identification
    - Proper Shipping Name List the proper shipping name (this is the name as it appears on the List of Dangerous Goods Table and NOT the product or trade name), and if applicable, the technical name in parenthesis.
    - Class or Division List the class or division number and, if applicable, compatibility group.
    - UN or ID No List the UN or I.D. number, preceded with "UN" or "I.D." This selection may change when shipping in accordance with 49 CFR regulations that permit the shipment under NA (North American Continental Shipments) designations for certain substances.
    - Packing Group List the appropriate packing group, if applicable. This is the level of anticipated hazard of the shipment. It does not apply for all shipments. When no information is available, leave the space blank.
    - Subsidiary Risk List the class or division number of the subsidiary risk, if applicable. The subsidiary risk is any additional hazard beyond the most significant (or primary) hazard. This information is obtained from the List of Dangerous Goods Table.
  - 2. Quantity and Type of Packaging List the number of packages, the type of package, and the net quantity in each package. The type of packaging you are shipping the hazardous material in is presented first, followed by the amount (Kg, L, etc.). For example, "1 fiberboard box X 2 Kg". When no outer packaging is identified, the packaging selected must provide limited protection of the inner packaging by securing and cushioning during shipment. NOTE: Always use the package that the hazardous material was shipped to the site in. If it is not available, contact the Health Sciences Department in Pittsburgh for further instruction.
  - 3. Packing Instructions Enter the Packing Instruction number. These instructions are provided in Section 5 of the IATA Dangerous Goods Regulations. They provide the exact type of packaging required by the industry for various hazard classes. When no addition packaging considerations are given, the shipper may use their best judgment for the shipment of an identified substance and/or article.
  - 4. Authorization List the words "Limited Quantity," if applicable; list any special provision(s) or approval(s) if applicable. This section provides for exceptions to this transportation regulation and the conditions for those exceptions.

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- d) Additional handling Information Enter any required special handling information.
- e) Prepared for Air Transport according to: Check the ICAO/IATA box.
- f) Emergency Telephone Number Enter the 24-hour emergency contact number. This number is required of all US Origin or Destination Shipments. List the number for InfoTRAC (1-800-535-5053). InfoTRAC is a company retained by TtNUS to provide 24-Hour Emergency Hotline service for dangerous goods shipment. This company has MSDSs for the substances routinely shipped by TtNUS. They provide information to FedEx or any other emergency responders, should situations arise with one of our shipments. In addition, they have telephone numbers of certain Tetra Tech NUS Health Science Department personnel in the Pittsburgh Office in the event of an emergency.
- g) Name/Title of the Signatory Enter name and job title (Field Operations Leader, Geologist, Health & Safety Specialist, etc.)
- h) Place and date Enter the city and date of shipment
- i) Signature Sign the form (must be a complete signature). All alterations must be signed with the same signature used to sign the declaration.

#### 5.4.3.4 Transportation

- 1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult Health Sciences.1
- 2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.
- 3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.
- 4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

#### 5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are typically powered by lithium batteries in sufficient quantity to make the unit subject to hazardous material shipping requirements. The DOT determined that lithium batteries are to be shipped using the following information:

Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact Health Sciences so that a decision can be made as to the proper shipping practices. The DOT and IATA penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

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- Product Designation
  - Hermit SE 1000
  - Hermit SE 2000
- Proper Shipping Name
  - Lithium batteries, contained in equipment, UN3091
- UN No UN-3091
- Classification or Division
  - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container and include all the information noted under Section 5.4.3.2. Instead of the Flammable Liquid information, however, the following will be presented with the following wording:

- Lithium Batteries Contained in Equipment
  - UN-3091
- DOT Miscellaneous Hazardous Materials (Class 9) label
- "Cargo Aircraft Only" label

#### 6.0 REFERENCES

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#### ATTACHMENT A

#### GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample 1	Type and Concentra	tion	Container <sup>(1)</sup> Sample Size		Preservation <sup>(2)</sup>	Holding Time <sup>(2)</sup>	
WATER			-		1	·	
Organics (GC&GC/MS)	VOC	Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days <sup>(9)</sup>	
	Extractables SVOCs and pesticide/PCBs)	(Low	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction	
	Extractables SVOCs and pesticide/PCBs)	(Medium	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction	
Inorganics	Metals	Low	High-density polyethylene	1 L	HNO₃ to pH ≤2	6 months (Hg-28 days)	
		Medium	Wide-mouth glass	16 oz.	None	6 months	
•	Cyanide	Low	High-density polyethylene	1 L	NaOH to pH>12	14 days	
	Cyanide	Medium	Wide-mouth glass	16 oz.	None	14 days	
Organic/ Inorganic	High Hazard		Wide-mouth glass	8 oz.	None	14 days	
SOIL			•		•	<u> </u>	
Organics (GC&GC/MS)	VOC		Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days	
	Extractables SVOCs and pesticides/PCBs)	(Low	Wide-mouth glass	8 oz	Cool to 4°C	14 days to extraction, 40 days after extraction	
	Extractables SVOCs and pesticides/PCBs)	(Medium	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction	
Inorganics	Low/Medium		Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)	
Organic/Inorga nic	High Hazard		Wide-mouth glass	8 oz	None	NA	
Dioxin/Furan	All		Wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction	
TCLP	All		Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction	
AIR							
Volatile Organics	Low/Medium		Charcoal tube - 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended	

Volatile	Low/Medium	Charcoal tube - 7 cm long,	100 L air	Cool to 4°C	5 days recommended
V Olduic	Lowing	Crianco ar labe = rain lang,		C00110 4 C	o days recommended
Organics		Emm OD 4 mm ID			
Organics	i	6 mm OD, 4 mm ID			•
T		1			!

All glass containers should have Teflon cap liners or septa. See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

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#### ATTACHMENT B

## ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container <sup>(1)</sup>	Preservation <sup>(2)(3)</sup>	Maximum Holding Time <sup>(4)</sup>	
INORGANIC TESTS:				
Acidity	P, G	Cool, 4°C	14 days	
Alkalınıty	P, G	Cool, 4°C	14 days	
Ammonia - Nitrogen	P, G	Cool, 4°C; H₂SO₄ to pH 2	28 days	
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours	
Bromide	P, G	None required	28 days	
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H₂SO₄ to pH 2	28 days	
Chloride	P, G	None required	28 days	
Chlorine, Total Residual	P, G	None required	Analyze immediately	
Color	P, G	Cool, 4°C	48 hours	
Cyanide, Total and Amenable to Chlonnation	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid <sup>(5)</sup>	14 days <sup>(6)</sup>	
Fluoride	P	None required	28 days	
Hardness	P, G	HNO <sub>3</sub> to pH 2; H <sub>2</sub> SO <sub>4</sub> to pH 2	6 months	
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H₂SO <sub>4</sub> to pH 2	28 days	
Nitrate - Nitrogen	P, G	None required	48 hours	
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH 2	28 days	
Nıtrıte - Nıtrogen	P, G	Cool, 4°C	48 hours	
Oil & Grease	G	Cool, 4°C; H₂SO₄ to pH 2	28 days	
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H₂SO₄ to pH 2	28 days	
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours	
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately	
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours	
Phenols	G	Cool, 4°C; H₂SO₄ to pH 2	28 days	
Phosphorus, Total	P, G	Cool, 4°C; H₂SO₄ to pH 2	28 days	
Residue, Total	P, G	Cool, 4°C	7 days	
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days	
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days	
Residue, Settleable	P, G	Cool, 4°C	48 hours	
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days	
Silica	Р	Cool, 4°C	28 days	
Specific Conductance	P, G	Cool, 4°C	28 days	
Sulfate	P, G	Cool, 4°C	28 days	

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# ATTACHMENT B ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES PAGE TWO

Parameter Number/Name	Container <sup>(1)</sup>	Preservation <sup>(2)(3)</sup>	Maximum Holding Time <sup>(4)</sup>
INORGANIC TESTS (Cont'd):			
Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:(7)		<u> </u>	
Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO₃ to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO <sub>3</sub> to pH 2	6 months
ORGANIC TESTS:(8)		·	
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup> HCl to pH 2 <sup>(9)</sup>	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup> adjust pH to 4-5 <sup>(10)</sup>	14 days
Phenols <sup>(11)</sup>	G, Teflon-lined cap	Cool, 4°C, 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	7 days until ersaction, 40 days after extraction
Benzidines <sup>(11), (12)</sup>	G, Teflon-lined cap	Cool, 4°C; 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	7 days until extraction <sup>(1-)</sup>
Phthalate esters <sup>(11)</sup>	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Nitrosamines <sup>(11), (14)</sup>	G, Teflon-lined cap	Cool, 4°C; store in dark; 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	7 days until extraction; 40 days after extraction
PCBs <sup>(11)</sup>	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Nitroaromatics & Isophorone <sup>(11)</sup>	G, Teflon-lined cap	Cool, 4°C, 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup> ; store in dark	7 days until extraction, 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs) <sup>(11)</sup> ,(14)	G, Teflon-lined cap	Cool, 4°C; 0 008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup> ; store in dark	7 days until extraction; 40 days after extraction
Haloethers <sup>(11)</sup>	G, Teflon-lined cap	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF)(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>(5)</sup>	7 days until extraction; 40 days after extraction

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# ATTACHMENT B ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES PAGE THREE

(1) Polyethylene (P) generally 500 ml or Glass (G): generally 1L.

- (2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
- (3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
- (4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.

(5) Should only be used in the presence of residual chlorine.

- (6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
- (7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
- (8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

- (10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
- (11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0 003% sodium thiosulfate, storing in the dark and adjusting the pH to 6-9, samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re-the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 12 (re-the analysis of benzidine)
- (12) if 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
- (13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere
- (14) For the analysis of diphenylnitrosamine, add 0 008% Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> and adjust pH to 7-10 with NaOH within 24 hours of sampling.
- (15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0 008% Na<sub>2</sub>S<sub>2</sub>O;

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#### **ATTACHMENT C**

## DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2a)

- 1. Radioactive material (except a limited quantity)
- 2. Division 2.3, Poisonous Gases
- 3. Division 2.1, Flammable Gas
- 4. Division 2.2, Nonflammable gas
- 5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
- 6. Division 4.2, Pyrophoric Material
- 7. Division 4.1, Self-Reactive Material
- 8. Class 3, Flammable Liquids\*
- 9. Class 8, Corrosive Material
- 10. Division 4 1, Flammable Solid\*
- 11 Division 4.2, Spontaneously Combustible Materials\*
- 12. Division 4.3, Dangerous When Wet Materials\*
- 13. Division 5.1, Oxidizers\*
- 14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)\*
- 15. Combustible liquid
- 16. Class 9, Miscellaneous Hazardous Materials
- \* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

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#### **ATTACHMENT C (Continued)**

## DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2a)

Class	Packing Group	4.2	4.3	51 I <sup>(a)</sup>	5.1 II <sup>(a)</sup>	5 1     <sup>(a)</sup>	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8   (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	(c)	3	(c)	3	(c)
3	II						3	3	3	3	8	(c)	3	(c)	3	(c)
3	III						61	6.1	6.1	3 <sup>(d)</sup>	8	(c)	8	(c)	3	(c)
4.1	II <sub>P</sub>	4.2	43	5.1	41	4.1	6.1	6.1	4.1	4.1	(c)	8	(c)	4.1	(c)	4.1
41	IIIp	4.2	43	5.1	4.1	4.1	6.1	6.1	6.1	4.1	(c)	8	(c)	8	(c)	41
4.2	11		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	(c)	8	(c)	4.2	(c)	4.2
4.2	łII		4.3	51	42	4.2	6.1	6.1	6.1	4.2	(c)	8	(c)	8	(c)	4.2
4.3	1			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	=			5 1	43	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
43	≡			5.1	4.3	4.3	6 1	6.1	6.1	43	8	8	8	8	4.3	4.3
5 1	l <sup>a</sup>						5 1	51	5 1	5.1	5.1	5.1	5 1	51	5 1	5 1
51	lla						61	51	51	51	8	8	8	51	5 1	5 1
5 1	III <sup>a</sup>	L					6 1	6 1	61	5 1	8	8	8	8	5 1	5 1
€ 1	I, Dermal					<u> </u>					3	6;	€ 1	€ (	3 *	6.1
6 1	I, Oral										8	61	€ 1	6.1	61	0.1
61	II, Inhalation										8	61	61	6 1	6 1	6 1
61	II, Dermal										8	61	8	61	61	61
61	II, Oral										8	8	8	6 1	6.1	61
6 1	111										8	8	8	8	8	8

<sup>(</sup>a) There are at present no established cnteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great, Group II, Medium, or Group III, Minor Danger

<sup>(</sup>b) Substances of Division 4.1 other than self-reactive substances'

<sup>(</sup>c) Denotes an impossible combination.

For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6 1, Packing Group III, the primary hazard is Division 6 1, Packing Group III

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#### ATTACHMENT D

#### **GUIDE FOR HAZARDOUS MATERIALS SHIPPERS**

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

#### STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

- a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
- b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
- c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

#### STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

- a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
- b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels

## STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION

- a As a shipper, you must assure yourself that the shipment complies with various is our requirements
- b. The modal requirements may affect the following (1) Packaging, (2) Quantity per Package, (3) Marking; (4) Labeling, (5) Shipping Papers; and (6) Certification

# STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED

- a. Refer to the Table, 49 CFR 172 101, Column (4) for required labels.
- b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402, (2) Placement of Labels, 49 CFR 172 406, (3) Packagings (Mixed or Consolidated), 49 CFR 172 404(a) and (h), (4) Packages Containing Samples, 49 CFR 172.402(h), (5) Radioactive Materials, 49 CFR 172 403, and (6) Authorized Label Modifications, 49 CFR 172.405.

# STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

- a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
- b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

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# ATTACHMENT D (Continued) GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

# STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

- a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
- b. For details and other required markings, see 49 CFR 172.300 through 172.338.

# STEP 8 - PREPARE THE SHIPPING PAPERS.

- a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
- b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

#### STEP 9 - CERTIFICATION.

- a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).
- <u>STEP 10 LOADING, BLOCKING, AND BRACING</u>. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.
  - a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading blocking, and bracing of the materials
  - billion committee that in the cameric more of the
- STEP 11 DETERMINE THE PROPER PLACARD(S) Each person who offers hazar his an term's for transportation must determine that the placarding requirements have been met
  - a For Highway, unless the vehicle is alread, correctly placarded, the shipper must, or following required placard(s) and required ID number(s) (49 CFR 172 506).
  - b For Rail, if loaded by the snipper, the snipper most placar tithe rail car if placards are required. (49 CFR 172 508).
  - c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards

### STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

- a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
- b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect the shipment. The shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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#### ATTACHMENT E

#### HAZARDOUS MATERIALS SHIPPING CHECK LIST

## **PACKAGING**

- 1. Check DOT 173.24 for appropriate type of package for hazardous substance.
- 2. Check for container integrity, especially the closure.
- 3. Check for sufficient absorbent material in package.
- 4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

## **SHIPPING PAPERS**

- 1. Check that entries contain only approved DOT abbreviations.
- 2. Check that entries are in English.
- Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.
- 4. Be careful that all hazardous classes are shown for multiclass materials
- 5 Check total amounts by weight, quantity, or other measures used
- 6 Check that any limital cuprett a complement and the temperature of the control - 7 Check that construct the second as chaper
- 8 Make certain driver sions for chiliment

#### TO THE SHE SHE

- 1. Check that approved state/federal manifests are prepared
- 2 Check that transporter has the following valid EPA identification number, welfid driver's fich as in the vehicle registration, insurance protection, and proper DOT labels for materials being shipped
- 3. Check that destination address is correct.
- 4. Check that driver knows where shipment is going.
- 5. Check that the driver is aware of emergency procedures for spills and accidents.
- 6. Make certain driver signs for shipment.
- 7. Make certain one copy of executed manifest and shipping document is retained by shipper.

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# **ATTACHMENT F DOT SEGREGATION AND SEPARATON CHART**

Class or Division	Notes	1.1- 1.2	13	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 Iquids PG-I Zone A*	7	8 liquids only
Explosives 1 1 and 1.2	Α	*	•	*	*	•	X	X	Х	Х	Х	X	Х	Х	Х	X	Х	X	X
Explosives 1.3		*	•	*	*	٠	x		Х	X	Х		х	Х	х	х	X		X
Explosives 1.4		*	•	*	*	٠ ا	0		0	0	0		0				0		0
Very insensitive	Α	*	•	٠ ا	*	•	X	X	Х	х	Х	х	х	X	х	х	X	×	x
explosives 1.5						ŀ							İ		ŀ				ĺ
Extremely insensitive		*	•	•	•	*													
explosives 1.6						l	l												
Flammable gases 2.1		Х	x	О	x	l			х	0							0	0	
Non-toxic, non-		Х			х	l	l												
flammable gases 2.2						l													
Poisonous gas -		Х	x	0	х		x				х	х	x	х	х	x		1	l x
Zone A** 2.3						İ							l						
Poisonous gas -		Х	×	0	х		0				О	0	0	0	0	0			0
Zone B** 2.3							l							ľ		•		ŀ	
Flammable liquids 3		Х	X	0	×	[	ļ	l	Х	0					0	]	X	1	ľ
Flammable solids 4 1		Х			x				X	0				İ			×		0
Spontaneously combustible		×	×	0	x			,	×	0							×	<u> </u>	×
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Ovidinois 51	^	Y	X		X		1	-	X	0	l e	1					1 ,		1 0
Organic policinal is 52		λ	Х		X		i		>	G	<b> </b>	! !					\		1 3
Poisonous liquids PGT -		¥	λ	0	X		c			1	Х	λ	,	У	У	X	!		l x
Zone A** 0.7			l	i	1	i	i		i		Ì		İ	1	1	İ	1	i	Ì
Radioactive materials 7		Х			x		0				-								
Corrosive liquids 8	}	Х	x	0	Ιx		ŀ	1	X	0		0	x	0	0	0	l x		[

No entry means that the materials are computible (have no restrictions)

- X These materials may not be loaded, transported, or stored together in the same vehicle or facility.O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides

  Check the explosives compatibility chart in 49 CFR 179.848(f)

  A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.

  Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class

- 1 before shipment.

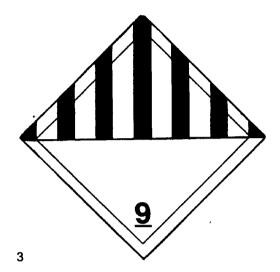
3224637861  TRANSPORT DETAILS  This shipment is within the limitations prescribed for: (deleter non applicable)  CARGO AleCHAFT ONLY  Airport of Destination:  19CYS		comply in all respects with the smay be in breach of the applicable by a consolidator, a forwar (delete non-applicable)	applicable D licable taw, circumstanc	angerous Goods subject to legal es, be completed		HANDLING	NON-RADIOLOGICAL SAMPLE
NATURE AND QUANTITY OF DANGEROUS GOODS					] <b>\'</b>	ĺ	FE
	51 ; r) .	Quantity and type of packing	Packing inst.	Authorization	в моїнти		
LITHIUM BATTERIES CONTAINED 9 UN 09 IN EQUIPMENT		LAŞTIÇEBÖX X S55- GRAMS	912 II	PER CA-9206009	ATTACHMENT G BATTERY SHIPPING PAPERS	Revision 1	Number SA-6.1
Additional Handling Information				•	, °		
1 HERMIT SERIES DATALOGGER X 55 GK Pto Characteristics of this consignment are fully and shipping name and are classified, packed, marked, and is belied, and are for transport by air according to the applicable international are rect.  Emergency Telephone Number (Required for US Origin or Destination Shipments)  800-535-5053  IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINMENT DIAGNOSIS, OR TREATMENT.		by proper or condition regulations  Place and Date Signature (see warning above)	TO, RESEARCH,	MEDICAL		Effective Date 03/00	Page 23 of 24

Subject

Subject NON-RADIOLOGICAL SAMPLE	Number SA-6.1	Page 24 of 24
HANDLING	Revision 1	Effective Date 03/00

# ATTACHMENT G (CONTINUED) LITHIUM BATTERY SHIPPING PAPERS





**UN-3091. SHIPPED UNDER CA-9206009** 

APPENDIX B

FIELD FORMS

					Page 01
TETRA TI	ECH NUS, INC.		SAMPLE LO	OG SHEET - SOLID PHASE	
Site Name:Sample ID:			Tetra QC In	Tech, NUS Job No./PMS formation:	(if applicable)
Sample Method:  Depth Sampled:  Sample Date & Time:  Sampler(s):	hours	Duphours	TYPE OF SAMPLE: (Che Soil Sediment Lagoon/Pond Grab	Trip Blank* Rinsate Blank* Field Duplicate collected Other (Specify):	
	: Reading:	Signature	ppm	Etc.)	, Muck, Peat, Dry, Moist, Wet,
SAMPLE DATA/RE	EMARKS:				
ANALYSIS	BOTTLE LOT NO.	NOTES/SKETCH:			

Tt NUS Form 0005A

Sample Method/Device: Depth Sampled:	TE TETR	A TECH NUS, I	INC.			SAMPLE LOG	SHEET - LIQUID F	PHASE	
Depth Sampled:	Site Name: Sample ID:					Tetra Tech N QC Informati	IUS Job No./PMS on:	(it	f applicable)
Well Depth         feet         Purge Start         hrs         Sampling/Purge Data:           Vol. #         Temp °C         pH         Spec. Cond.         D           Inside Diameter         Inches         Purge Stop Time         hrs         0	Depth Sampled Sample Date & Sampler(s):	:feet Time:/_	: Total Depti /	h	ours	Groundw Surface V Residenti Grab	ater Vater al Supply	Trip Blank* Rinsate Blank* Field Duplicate Other (Specify	Collected ():
Vol. #   Temp   C   pH   Spec. Cond.   D	WELL PURGE D	DATA:				Micro Tip/OVA	Monitor Reading:		ppm
Water Level feet Total Gallons Purged  Well Volume gal. Purge Method  Color: Turbidity: CLR/SL CLDY/CLDY/OPAQ  ANALYSIS BOTTLE LOT NO. TRAFFIC REPORT NO. COMMENTS					Vol. # 0 1	-	pH	Spec. Cond.	DO
Color: Turbidity: CLR/SL CLDY/CLDY/OPAQ  ANALYSIS BOTTLE LOT NO. TRAFFIC REPORT NO. COMMENTS			Purged						
ANALYSIS BOTTLE LOT NO. TRAFFIC REPORT NO. COMMENTS		<u> </u>		DV/CLDV/OBAO	4				
ORGANIC INORGANIC					TRAFFIC F	REPORT NO.		COMMENTS	
					ORGANIC	INORGANIC			
L					<del></del>				

TETRA TECH	NUS, INC.		FIELD INSTRUMENT	CALIBRATION LOG	
INSTRUMENT NAME: _			MO	DDEL NO.:	
SERIAL NO.:		DECAL NO.:	TETRA	TECH NUS JOB NO./PMS	3
CALIBRATION DATE	INITIAL READING	PROCEDURE	FINAL READING	SIGNATURE	COMMENTS
`					
	,				

TE TETRA T	ECH NUS, INC.	S	SITE ENTRY LO	G
Site Name:		Da	ate:	
Location:		Pro	eject Number	
NAME	REPRESENTING	TIME IN (HOURS)	TIME OUT (HOURS)	INITIALS
		-		
				4:0 to 11
	-			
:	<u> </u>			
,				

TETRA TECH NUS INC.	FIELD MODIFICATION RECOR
Site Name:	Location:
	Task Assignment:
	cation: Date:
Reason for Change:	
Recommended Action:	
·	,
	Date:
Disposition/Action:	
Project Manager (Signature):	

Others as Required:

Tt NUS Form 0003

Project Manager:

Project File:

Quality Assurance Officer: Field Operations Leader:

TE TETRA TECH NUS, INC.				SAMPLE COLLECTION SUMMARY RECORD										
PROJECT NA	ME:	TETRA TECH NUS JOB NO./PMS:												
											DAS NO.:			
DATE	TIME	SAMPLE LOCATION		FIELD QC							COMMENTS			
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TETRA TECH NUS, INC.	RECORD OF FIELD WORK ORIENTATION Page of											
SITE:		JOB NO.:										
WORK ASSIGNMENT NO.:												
TASK OR ACTIVITY:	DATE OF ORIENTATION:											
PERSONNEL ATTENDING	TRAINERS		FOL	PROJECT								
MGR.				, 4								
1.	1.	1	•	1.								
2.	2.											
3.	3.											
4.												
5.												
6.												
7.												
VERIFICATIONS (CHECK AND INITIAL	BY ATTENDEES)											
WORK PLAN SAP/QAPP SOGS REVIEWED REVIEWED REVIEWED	SITE/EQUIP. SECURITY REVIEWED		H&S PLAN REVIEWED	PURCHASING	INITIALS							
1												
2				<u> </u>								
3												
5												
6												
7		<del></del>										
RETURN ORIGINAL TO THE QUALITY ASSURANCE OFFICER												
Copies to: PROJECT FILE:			<del></del>									
PROJECT MANAGER:												
PROGRAM MANAGER:												

Tt NUS\_Eorm\_0029